TITLE OF THE INVENTION

SYSTEMS, DEVICES AND METHODS FOR OPENING A BOTTLE SEALED WITH A STOPPER AND FOR SEALING A BOTTLE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation of copending U.S. application serial number 10/443/461 filed on May 21, 2003, which is a continuation-in-part of copending U.S. application serial number 10/306,633 filed on November 27, 2002, which is a continuation of U.S. serial number 09/760,375 filed on January 12, 2001, now U.S. Patent No. 6,510,957, incorporated herein by reference, which is a continuation-in-part of U.S. application serial number 09/273,838 filed March 22, 1999, now U.S. Patent No. 6,179,140, incorporated herein by reference, which is a continuation-in-part of U.S. application serial number 08/746,799 filed on November 18, 1996, now U.S. Patent No. 5,884,789, incorporated herein by reference. This application also claims priority from U.S. provisional application serial number 60/443,020 filed on January 27, 2003, incorporated herein by reference, and U.S. provisional application serial number 60/382,410 filed on May 21, 2002, incorporated herein by reference.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[0002] Not Applicable

INCORPORATION-BY-REFERENCE OF MATERIAL SUBMITTED ON A COMPACT DISC

[0003] Not Applicable

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BACKGROUND OF THE INVENTION

1. Field of the Invention

[0005] This invention pertains generally to devices and methods for sealing and opening bottles or similar containers and, more particularly, to extracting a stopper from a bottle by rotating a sleeve that is threaded onto the bottle.

2. Description of the Background Art

[0006] Wine and various other beverages, as well various liquid food products, are often packaged in glass bottles that are sealed with a stopper. The stoppers can be made from variety of materials, but are typically fabricated from natural cork or a synthetic cork material. Difficulties encountered with opening stopper sealed bottles has led to a number of devices and methods for extracting the stoppers. Many of those devices consist of awkward, cumbersome, or clumsy, auxiliary cork removing devices (such as cork screws, cork pullers, pressure pumps, etc.).

[0007] In addition, "easy-open" containers such as snap-top cans and screw-cap bottles are well known. While such containers can be easier to open than stopper sealed bottles, they have not been widely adopted in certain industries, such as the wine. One particularly salient reason for lack of acceptance in the wine industry is that such "easy-open" containers lack the aesthetic appeal of corked bottles that is important to wine consumers. Another is that such "easy open" containers are not compatible with bottling lines.

[0008] Pressurized containers, such as bottles containing sparking wine,

present other challenges. One such challenge is opening the bottle without the risk of injury from a stopper being blown out of the bottle and becoming a projectile. A number of patents and publications attempt to address this danger inherent with sparking wine closures, such as the following patents which are incorporated herein by reference: U.S. No. 5,803,281, U.S. No. 4,592,477, U.S. No. 4,392,579, U.S. No. 4,076,142, U.S. No. 3,944,104, U.S. No. 3,847,295, PCT Published Application No. WO 97/28056, French No. FR 74 28101 and German No. DE 196 09 487 C1.

[0009] A completely adequate means for quick and easy removal of corks or other stoppers from wine bottles, for example, should meet four basic requirements. The first is that the stopper should provide an adequate seal against the inside walls of the neck of the bottle. The second is that a permanently installed pulling device should not protrude through the bottom or sides of the stopper and should not split or tear the stopper because of the likelihood of resultant wine leakage and/or wine oxygenation or other contamination. The third is that installation of the stopper and stopper-puller mechanism into the wine bottle should not unduly complicate the present bottle-corking technology used throughout the industry. The fourth is that the stopper should be easily extractable by the consumer without the use of a cumbersome auxiliary device.

[0010] The foregoing requirements are also applicable to other bottled beverages as well as to some liquid foods. Furthermore, bottlers continually seek advanced closure designs to improve the aesthetics and usage factors for non-cork closures, such as currently served by the metal screw-cap market, or similar non-corked bottle segments of the market.

[0011] Therefore, a need exists for an apparatus that allows for "easy extraction" of the stopper while still providing an adequate stopper/glass seal that meets the four basic requirements outlined above. As used herein, "easy extraction" means that no cumbersome, awkward, or clumsy auxiliary equipment, such as cork screws that must be screwed into the stopper by the consumer, blade style removers that require inserting a pair of blades

between the stopper and bottle, or air-pump removers that require a needle to be forced through the stopper and air pumped into the bottle to increase pressure, and so on, is required of the consumer, and that adequate pulling forces are as easily applied as with conventional cork screws. A further need exists for advanced closures, with or without corks, that provide adequate sealing, may be opened without resorting to the use of external equipment, and which satisfy seal integrity, taste, and aesthetic criteria for a variety of bottled fluid products. The present invention satisfies these needs, as well as others, and overcomes the deficiencies of previously developed bottle closures.

BRIEF SUMMARY OF THE INVENTION

[0012] The present invention pertains to various embodiments of sleeved closure capsules, and associated adaptations of stoppers and bottles, that can provide the desirable appearance and use factors of traditional corked bottles while simplifying opening the bottle and serving the beverage. In many cases, bottling costs can also be reduced by employing the systems, devices, and methods of the present invention. The invention is particularly well suited for use with beverages such as still wines and sparkling wines (champagnes), although it may be used in connection with bottles that contain other types of liquid food products.

[0013] In general terms, several aspects of the invention are to provide for (1) extracting the stopper (e.g., cork) in response to torque that is easily applied by the user without a separate tool, (2) storing a reseal cap as part of the traditional-looking package, (3) resealing the bottle without reusing the stopper, (4) providing a drip resistant pour spout, (5) masking the threads of the bottle neck to simulate a foil-finished bottle, and (6) preventing inadvertent seal loss and providing tamper indications.

[0014] In accordance with an aspect of the prevent invention, a bottle sealed with a stopper is opened by rotating a sleeve that is annularly disposed about the neck of the bottle.

[0015] According to another aspect of the invention, the seal or stopper is

removed from the bottle by rotating a closure capsule that is disposed about the bottle neck. The closure capsule comprises at least a threaded sleeve, and may include other elements adapted for removing the stopper and/or resealing the bottle.

[0016] According to another aspect of the invention, the closure capsule forms a part of an overall closure system, also referred to as a closure, that can include a seal or stopper assembly.

[0017] One of the objectives for many of the embodiments of the present invention is that of simulating the appearance of traditional foil-wrapped bottles. It will be appreciated, for example, that the appearance of threads on a wine bottle have often been perceived as a sign of low quality wine due to their association with the use of metal screw caps used to seal bottles containing lower quality still and sparkling wines. Although the present invention relies on threads on a bottle for functionality, an aspect of the invention is to hide the threads and provide the appearance of a conventional foil wrapped bottle.

[0018] Another object of the invention is to minimize potential undesirable consumer perception associated with the present invention. Accordingly, another aspect of the invention is to provide a closure capsule that can be reinstalled on the bottle after removal. After removing the stopper from the bottle by rotating the sleeve of the closure capsule, a wine steward, waitperson, or consumer can generally spin the capsule back onto the bottle to retain the desired bottle aesthetics.

[0019] The closure embodiments described herein may be generally divided into four functional types; namely, natural cork-based closures for non-pressurized and pressurized fluids (including traditional corks, agglomerated corks, and technical corks made of a mixture of finely ground cork and a bonding agent), and synthetic cork-based closures for non-pressurized and pressurized fluids. Non-pressurized closures are directed toward applications such as still wine and olive oil, while pressurized closures are directed toward applications such as champagne, sparkling wine, beer, and sparkling juices.

[0020] Table 1 summarizes general closure types according to the present invention. The described bottle closures span a number of variations and improvements suitable to a wide variety of applications, cost factors, and aesthetic criteria. A number of embodiments of the present invention are described in which bottles are opened by unthreading an elongated sleeve portion of a closure capsule. The bottles may be sealed with plugs and/or planar seals.

[0021] In one embodiment of the invention, the sleeve portion of the capsule is generally configured as a structural element, typically fabricated from a polymeric material, that surrounds a substantial lengthwise portion of the neck of the bottle. The length of the sleeve generally exceeds its diameter or the bottle diameter, and is more preferably about one and one half times (1.5X) to about four times (4X) the sleeve or bottle diameter, depending in part on the length of the stopper to be removed. Longer sleeves may be utilized in particular if sleeve length is measured inclusive of capping elements. The above sleeve-length criteria are generally applicable to the various embodiments of closures described herein. Threads are disposed along a substantial axial portion of the interior of the sleeve for engaging exterior bottle threads.

[0022] Plug sealing according to the present invention comprises the use of anchored or anchorless stoppers, formed into appropriate shapes, for retention within the neck of the bottle to plug the pouring spout and thereby stop fluid flow within the bottle neck. By way of example, a specially designed anchor may be installed within the compliant material of the stopper, which typically comprises either natural cork stoppers, or synthetic cork stoppers, as employed within the wine industry, whereby cork removal is performed by rotating an associated closure capsule which engages the anchor to open the bottle. The closure capsule of the present invention preferably replaces the traditional metal foil capsule.

[0023] Under rotation of the closure capsule in relation to the bottle, an axial force is exerted on the anchor which extracts the stopper from the bottle. The

closure capsule provides a mechanical advantage in the conversion of the applied torque to the resultant axial extraction force. It will be appreciated that various levels of mechanical advantage are provided by the closure capsules of the invention depending on thread pitch and number of thread leads. A beneficial aspect of the cork pulling designs is that the cork is not fastened to the closure capsule and, therefore, is not subjected to rotation in response to the rotation of the closure capsule unless friction is overcome. It will be appreciated that the total work required of the user for rotating a cork of conventional size and shape within a bottle while performing axial cork extraction would increase, relative to that required to extract the cork without rotating it. The engagement between the closure capsule and anchor head (attached to the stopper) is preferably configured to be dispersed over a wide area to allow for cost effective implementation of the closure elements, such as being molded from polymeric materials (i.e. thermoplastics).

[0024] In some embodiments of the present invention, the closure capsules are configured to engage the exterior of an anchor head having a diameter equal to or preferably greater than approximately one-half the inside bottle neck diameter, although it is more preferably approximately equal to one and one-third the inside bottle neck diameter. One embodiment uses a multipart anchor, and more preferably a two-part anchor which allows bottling to be performed without the need for additional bottling steps and/or new machinery. The use of two-part anchors can shift the risk of application failures from winery bottling lines to a smaller set of cork preprocessors and perhaps distributors, because the anchor is joined to the compliant stopper portion before delivery to the bottling line where the stopper with anchor is inserted into the bottle.

[0025] In one embodiment, the two-part anchor comprises a shank member for retaining a compliant layer about the exterior of the shank. The shank is configured for attachment to a head member capable of receiving an axial stopper extraction force in response to unthreading of a sleeve threadably engaged on the bottle neck. The two-part anchor incorporates a radially

symmetric or annular latch mechanism whereby the anchor head can be latched to the shank, after the shank is coupled to the compliant layer and inserted into the bottle. It will be appreciated that the shank may be coupled to the compliant layer by threading it into a cork or other compliant material, molding the shank within a compliant material, or by additional means without departing from the teachings of the present invention. By way of a first example, the shank is configured for installation within a stopper, such as comprising a cork. By way of a second example, the shank is an elongated frame structure upon which an elastic material is joined (i.e. molded), wherein the combination forms an anchored stopper.

[0026] The head member preferably comprises an annular member disposed above the sleeve for engagement by a portion of the closure capsule when rotated to effect stopper extraction. An annular rib or lip, or other portion of the closure capsule is configured to engage the head member and apply an extraction force to the stopper. The sleeve is preferably configured with internal threads which mate with external threads on the outer surface of the neck of the bottle, or another mating sleeve attached to the outer surface of the bottle.

[0027] In one embodiment, means is provided for mechanically coupling the anchor shank and anchor head. Preferably this is performed in response to threading the closure capsule and its optional top cover, such as a reseal cap, onto the bottle after installing a stopper having an embedded anchor shank into the bottle. Pushing axially on the optional top cover or the anchor head while, rotating the capsule in relation to the bottle, causes axial pressure to be exerted on the annular head and the attached anchor shank and stopper. The anchor head is thereby pushed onto the anchor shank where it is latched into place.

[0028] It should be appreciated that the use of right-hand or left-hand threads on the bottle are substantially equivalent, although right-hand threads are preferred as they are more common which may reduce confusion when users attempt to open the bottle. It is preferred that, if right hand threads are used

on the bottle and a threaded anchor shank is used, the shank threads be configured as left handed threads to prevent possible unscrewing of the shank due to friction between the sleeve and the anchor head when the sleeve is unscrewed. This configuration of closure enables the consumer to easily apply a low-level torque that produces a well controlled pulling forces equivalent to those currently generated by auxiliary cork screws within a self-contained assembly that is readily and inexpensively manufactured and utilized by wineries and other bottlers, such as of wine or other fluids.

[0029] This closure method allows wine or other producers to utilize conventional natural or synthetic cork materials to assure proper sealing of the wine or other fluid being retained. In addition, the present invention may be utilized with high-speed mechanized corking equipment typical to the industry, without introducing a new source of contamination.

[0030] The use of "anchorless" natural or synthetic corks is also an aspect of the invention, wherein the cork is shaped so as to be engaged by the closure capsule. Methods are described for inserting anchorless corks into the bottle either before or after coupling of the closure capsule to the bottle. By way of example, corks similar in shape to traditional sparkling wine corks, after deformation during bottle corking, may be engaged directly by the cork-removal sleeve, while substantially cylindrical corks may be adapted, such as with exterior recesses, for being engaged by the closure capsule.

[0031] Other embodiments of the invention use cork-free forms of closures, wherein a bottle with a threaded top is sealed with an elongated closure capsule in which a fixed or removable seal portion is retained. The closure capsule provides the same appearance as a foil-wrapped bottle neck, but this form of closure provides an economic sealing alternative while overcoming the aesthetic shortcomings, and concomitant consumer resistance, of "screw-cap" bottles. Variations are described utilizing multi-part sleeves, seal plugs, and tamper indicative features.

[0032] Additional aspects of the invention may be applied to a number of the closures described herein. A method is also described for configuring the

interface between the closure capsule and the bottle so that a desired appearance is attained, such as following the shape of a conventional wine bottle.

[0033] According to another aspect of the invention, bottles utilized with the closure capsules of the invention are adapted with exterior threads to engage the interior of the sleeve of the capsule. Preferred bottle adaptations include a recess below the threads, referred to herein as a "choke ring" to allow the bottle to be grasped by machine tools, such as during bottle manufacture. The circumferential depression in the bottle neck forming the choke ring is utilized in place of the usual protruding ring that is needed to grasp the bottle during the molding process. The upper portion of the bottle neck, such as the corkage area, is preferably narrowed to accommodate the thickness of the sleeve portion of the capsule so that the exterior of the threaded-on capsule conforms to the contours of the bottle making it appear as a generally conventional bottle wrapped with a foil wrapper. It will be appreciated that traditional bottle necks have an outside diameter generally exceeding one inch (1 inch), and are more typically in the range of from one inch (1 inch) diameter to one and one half inch (1.5 inches) diameter, with a common outside diameter being one point three inches (1.3 inches). The interior at the base of the capsule is preferably tapered to conform to the transition in bottle diameter leading into the narrowed portion of the neck.

[0034] The closure capsules provide mechanical leverage that allow removing bottle corks, or other stoppers, easily and controllably. Threads on the sleeve portion of the closure capsules enable the conversion of a manual torque (e.g., approximately 20 pound-inches or less) applied to the capsule to deliver an axial force (e.g., up to approximately 100 pounds of force) for extracting a cork, while minimizing the number of turns of the capsule required to fully extract the cork.

[0035] Another aspect of the invention relates to features that prevent inadvertent loss of seal integrity on closures and/or indications that the seal has been compromised, such as in the case of bottle tampering. By way of

example, closure capsule rotation can be limited, such as by utilizing unidirectional protrusions, while retainers such as snap-rings or other mechanisms may be employed to serve as a latch. Additionally, tamper indications are preferably provided on all embodiments, such as through the use of a segmented capsule that separates when the capsule is unthreaded, engagements between the bottle and capsule that break or are overcome when the capsule is unthreaded, or frangible neck bands that break in response to twisting of the closure capsule.

[0036] Closures are described in which the bottle cap separates from the sleeve, allowing the sleeve, preferably with a drip-resistant edge, to be threaded into place extending past the mouth of the bottle to minimize dripping.

[0037] Means for resealing the bottle after opening, such as a reseal cap, may be incorporated as an aspect of the present invention as well. The resealing means may be implemented so as not to depart from the traditional appearance of the bottle, while providing a self-contained mechanism for resealing the contents, for example to prevent oxidation during storage. A threaded nipple portion can be preferably provided for certain embodiments within which a threaded cap is received. It should be appreciated that the cap may be configured to snap or thread onto the bottle for sealing and may be attached to the sleeve when not in use by threading, snapping, or other removable retention means such as frangible bonds, material links or the like.

[0038] A secondary seal means is also described as an aspect of the present invention, wherein oxygen is prevented from reaching the retained fluid, such as wine, even if the stopper seal integrity were compromised.

[0039] Pressurized bottle sealing is also described in which the stopper cork is prevented from uncontrolled, and possibly explosive, egress from the bottle.

[0040] It should be appreciated that the invention herein may be implemented in a number of alternative embodiments without departing from the teachings of the present invention. The following alternative descriptions are provided by way of example, and not of limitation.

[0041] In one embodiment, a two-piece cork anchoring apparatus and method is characterized by (a) a sleeve configured for threadable engagement about the neck of a bottle having exterior threads, (b) an anchor head adapted for being engaged by a portion of the sleeve, (c) an anchor shank configured for attachment to a bottle stopper, and (d) means for mechanical coupling of the anchor head to the anchor shank.

[0042] The stopper may comprise a natural or synthetic cork configured for being attached to an anchor shank, or an elastic material attached to an anchor shank configured as a frame for retaining the elastic material as a stopper.

[0043] The closure capsule is retained in contact with or proximal to the anchor head member. Rotation of the sleeve on the exterior bottle threads provides for engaging the anchor head member to apply force required in removing the stopper in response to the sleeve being unscrewed from the bottle.

[0044] The shank and head portions of the anchor may be joined in various ways such as utilizing mating connectors, (i.e. press-fit connectors), which preferably engage in response to the application of a sufficient engagement force (i.e. one to ten pounds) comprising a first level of force while threading the sleeve down onto the bottle. Once engaged, the shank and head should not become disengaged even when subjected to high cork extraction forces. Disengagement of the shank and head, therefore, should only arise in response to forces exceeding that expected for removing the stopper (i.e. over one hundred fifty pounds for a cork stopper). For example, this second level of force required to disengage the shank and head should be at least approximately fifty pounds, even for small corks. More preferably this second level of force should be within the range approximately fifty pounds to approximately three hundred pounds of axial force for bottles with inserted sealing plugs. It should be appreciated that actual extraction forces on a conventional cork have been found to exceed one hundred thirty pounds, and that the anchor shank and anchor head should not be subject to

disengagement upon application of axial forces of this magnitude.

[0045] In one embodiment of head to shank engagement, at least one protrusion on one member is received into at least one mating aperture in the other member. The members may include circumferential adaptations, such as slots, grooves, or the like, as a means of moderating engagement forces when attaching the shank to head. One or more ribs are preferably included on these members to accommodate a range of cork insertion depths into the bottle, typically approximately two tenths of an inch (0.2 inch).

[0046] Anchor shanks configured for insertion into natural or synthetic corks are preferably configured with means for automated engagement of the anchor shank by an automated insertion machine which allows the anchor shank to be automatically inserted into a stopper. Such means may be implemented using a mechanical engagement structure, such as a recess or protrusion (i.e. polygonal) on the upper portion of the shank member which is configured for urging the anchor shank into a stopper by automated mechanisms. A flange may be incorporated extending from the upper periphery of the anchor shank to control the depth of insertion of the anchor shank within a stopper. It will be appreciated that the anchor shanks may be preinserted into stoppers, preferably of cork or synthetic cork, such as by a cork manufacturer, thereby simplifying the bottling process and removing variables with regard to the cork-to-anchor interface.

[0047] The two piece, or multielement, anchor assembly makes possible a method of sealing a bottle with a removable stopper, which comprises: (a) inserting an anchor shank within a stopper configured for being inserted within the neck of a bottle for sealing the contents of the bottle, (b) inserting the stopper and retained anchor shank (with or without compression) into the neck of the bottle, (c) threading a capsule assembly onto the neck of the bottle, wherein the capsule has a threaded sleeve and a retained anchor head configured for engagement of the anchor shank, and (d) joining the anchor head of the capsule to the anchor shank by threading down the capsule onto the neck of the bottle whereby the bottle may be subsequently opened by

threading the capsule assembly up off of the bottle neck to supply an extraction force through the anchor head and the anchor shank to the stopper for removal.

[0048] Preferably, the anchor head is joined to the anchor shank by mechanically engaging at least one protrusion with at least one mating receptacle, for example protrusions which extend down from the head engage receptacles in the shank, or the converse receptacle-protrusion arrangement, or the use of similar coupling mechanisms.

[0049] As can be seen, according to an aspect of the invention, the closure capsule generally surrounds a portion of the bottle neck to provide a foil-wrapped appearance, or may be alternatively styled according to other desired aesthetics. The lower portion of the closure capsule is configured for being threaded down into a recess in the neck of a bottle onto which it is received, wherein a desired shape transition can be obtained between the bottle and the closure capsule, such as that of providing a foil-wrapped appearance. An upper portion of the closure capsule includes an engagement structure positioned for engaging the anchor head, preferably from underneath, although it may less preferably engage the head member from the sides or the top. Unscrewing, unthreading, of the closure capsule from the bottle neck results in breaking the bottle seal and opening of the bottle.

[0050] According to further aspects of the invention, bottle caps can be incorporated into the closure to provide for resealing and/or preventing uncontrolled explosive cork egress, such as preventing corks from becoming projectiles driven by bottle pressure. Reseal caps can seal the bottle by snapping over the rim of the pouring spout of the bottle or by being threaded over the top of the bottle neck and covering the pouring spout and rim, and may be retained atop the sleeve of the closure capsule by snap engagement, threads, or separable connection, such as molded tabs or bonding.

[0051] By way of further example, additional aspects of the invention include threaded bottles configurations for use with the closure capsules. Preferably

the threads extend from a lengthwise portion of the neck, for at least approximately one thread revolution, and preferably one to two (or more) thread revolutions at the desired pitch. A portion of the neck of these bottles is preferably recessed, wherein a smooth exterior is provided on the combination of capsule and bottle, such as appearing like a foil-wrapped bottle.

[0052] Preventing uncontrolled stopper egress from, for example, bottles of sparkling wines, champagnes, or beers similarly bottled, is another aspect of the invention. In one embodiment, an apparatus for removing a stopper from the pouring spout within the neck of a bottle comprises: (a) an anchor member having a shank portion configured for being retained within a stopper and a head portion attached to an upper portion of the shank, and (b) a sleeve having internal threads configured for threadably rotating on external bottle threads, (c) wherein the sleeve is configured to engage an underside of the head portion of the anchor member, and (d) means for restricting the passage of a stopper through the sleeve.

[0053] By way of example, and not of limitation, the stopper is preferably prevented from unrestricted passage through the sleeve by including a flange (i.e. annular flange) on an upper portion of the sleeve, at least a portion of which extends over the pouring spout of the bottle thereby constraining stopper egress. During unthreading of the sleeve from the bottle, the sleeve remains threadably engaged on the bottle until after the seal between the stopper and the bottle is broken, thereby preventing uncontrolled, and possibly explosive, egress.

[0054] The closure capsule may be configured as a threaded sleeve configured with a flange for engaging a stopper, whose upper end protrudes out from the rim of the pouring spout of the bottle, in response to unthreading of the sleeve from the bottle. A restraining cap is preferably retained over the stopper to prevent uncontrolled egress, such as when retaining pressurized fluids. The stopper being engaged may have a bulbous head, such as with sparkling wines, or other forms of protrusions or recesses which are adapted

for being engaged by the sleeve flange, or other engagement mechanisms of the sleeve. The engagement mechanisms can comprise engagement fingers for providing unidirectional engagement of portions of the stopper, allowing the stopper to be inserted through the sleeve during bottling, or the sleeve engaged over the stopper, according to a first direction, while under axial sleeve movement during unscrewing of the sleeve from the bottle, the engagement mechanisms sufficiently grasp the stopper to supply the necessary extraction force.

[0055] According to another aspect of the invention, the closure capsule can be designed as a single piece, with or without a bottle neck plug, and a portion of the sleeve, or cap, can be configured to at least partially engage the bottle for increasing the resistance to inadvertent seal loss. For example, in one embodiment, an apparatus for removing a stopper from the pouring spout within the neck of a bottle comprises: (a) a sleeve having internal threads configured for engaging threads exterior to the neck of a bottle, (b) a cap portion joined to the top of the sleeve, and (c) means for sealing a bottle, joined to the cap portion.

[0056] The length of the sleeve generally exceeds its diameter, and more preferably has a length approximately one and one half times (1.5X) to approximately four times (4X) its diameter, depending in part on the length of the stopper to be removed. The sealing means may be implemented in a number of alternative forms such as a natural cork, synthetic cork, molded polymeric plug (i.e. with sealing ridges about the annular periphery), substantially planar seals (for engaging and sealing against the top of the bottle), planar sections of compliant material, planar seals with flexible extending seal rings, combinations thereof and other forms of providing a fluid tight and oxygen-permeation-resistant seal on the rim and interior of the pouring spout of the bottle.

[0057] The cap and sleeve may be joined in such a manner as to allow for separation during opening of the bottle, which occurs in response to unthreading of the sleeve from the bottle. The lower sleeve portion may be

optionally configured with threads so after removal of the cap portion the remaining sleeve portion may be threadably engaged with the bottle threads forming a pour spout which preferably has a drip resistant edge.

[0058] It will be appreciated, therefore, that the present invention may be implemented in various ways and with various options. A number of objects of the invention should be readily apparent, including but not limited to, the following.

[0059] An object of the invention is to provide for the easy and convenient removal of a cork from a bottle.

[0060] Another object of the invention is to provide a cork removal apparatus that can be easily packaged with a bottle.

[0061] Another object of the invention is to avoid the requirement that the consumer perform the operation of anchoring a pulling device to the cork.

[0062] Another object of the invention is to avoid the requirement that the consumer force a device through, into, or along the sides of the cork.

[0063] Another object of the invention is that the consumer only be required to perform a simple unscrewing operation in order to uncork or otherwise open a sealed bottle.

[0064] Another object of the invention is that the consumer not be required, after uncorking a bottle, to unscrew a corkscrew or similar means from the cork.

[0065] Another object of the invention is to provide a cork removal apparatus that can be manufactured at low cost.

[0066] Another object of the invention is to provide a cork removal apparatus that can be employed with corks of various styles, compositions, and manufacture including natural corks, synthetic corks, agglomerated natural corks, technical corks, thermoplastic hollow elements, and others.

[0067] Another object of the invention is to provide a bottle closure that may be utilized on pressurized and non-pressurized bottles.

[0068] Another object of the invention is to provide a bottle closure that may be utilized with natural corks, synthetic corks, thermoplastic hollow elements,

and synthetic sealing elements.

[0069] Another object of the invention is to provide two-part anchoring of corks, wherein the cork with anchor may be inserted substantially traditionally with the anchor head and cork pulling sleeve attached thereafter.

[0070] Another object of the invention is to provide for the use of anchorless natural or synthetic corks that can be removed by simply performing a twisting operation on a capsule covering the top of the bottle.

[0071] Another object of the invention is to provide a threaded sleeve bottle opening apparatus having a traditional foil finished bottle appearance.

[0072] Another object of the invention is to provide a form of synthetic corkage utilizing an interior frame over which a compliant material is retained.

[0073] Another object of the invention is to provide bottle shapes that may be readily manufactured and which support the use of threaded closure capsules.

[0074] Another object of the invention is to provide a closure capsule which may be molded in a single piece, with integral seal or to which at least one seal element may be joined.

[0075] Another object of the invention is to provide a closure capsule in which a portion of the capsule breaks-away when the user attempts to open the bottle by applying torque to the sleeve of the closure capsule.

[0076] Another object of the invention is to provide mechanisms that prevent inadvertent unsealing of the bottle and indicate if a bottle has been unsealed.

[0077] Another object of the invention is to provide a drip-resistant pour spout.

[0078] Another object of the invention is to provide a bottle resealing means that is packaged with the bottle.

[0079] Another object of the invention is to provide a secondary seal that prevents oxidation of the fluid contents of a bottle despite primary cork seal failure.

[0080] Another object of the invention is to provide a method of preventing uncontrolled bottle cork egress in pressurized bottles.

[0081] Further aspects, objects and advantages of the invention will be

brought out in the following portions of the specification, wherein the detailed description is for the purpose of fully disclosing preferred embodiments of the invention without placing limitations thereon.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S)

[0082] The invention will be more fully understood by reference to the following drawings which are for illustrative purposes only:

[0083] FIG. 1 is a cross-section of a two-piece anchor assembly and capsule according to an aspect of the present invention, shown with a stud protruding from the anchor head which mates with a socket in the anchor shank.

[0084] FIG. 2 is a cross-section of the anchor shank of FIG. 1.

[0085] FIG. 3 is a top view of the anchor shank of FIG. 1.

[0086] FIG. 4 is a cross-section of a two-piece cork anchor assembly according to another aspect of the present invention, shown with a stud protruding from the anchor shank which mates with a socket in the anchor head.

[0087] FIG. 5 is a detailed view of the stud to socket interface of FIG. 4.

[0088] FIG. 6 is a top view of the engagement receptacle of FIG. 5.

[0089] FIG. 7 is a detailed view of teeth engagement between the stud and receptacle of FIG. 5.

[0090] FIG. 8 is the free-body diagram of the latching finger of FIG. 5.

[0091] FIG. 9 is a cross-section of a cork anchor shank with a split stud engaging an anchor head member according to another aspect of the present invention.

[0092] FIG. 10 is a top view of the anchor head member of FIG. 9.

[0093] FIG. 11 is a cross-section of a closure particularly well suited for sparkling wines or other pressurized fluids according to another aspect of the present invention, shown with a closure capsule that prevents uncontrolled cork egress.

[0094] FIG. 12 is a side view of the closure of FIG. 11 overwrapping the top of a bottle, such as found on sparkling wines.

[0095] FIG. 13 is a top view of the closure of FIG. 12.

[0096] FIG. 14 is a side view of the sleeve from the closure of FIG. 12.

[0097] FIG. 15 is a cross-section of a bottle closure particularly well suited for sparkling wines according to another aspect of the present invention, shown with a bulbous end stopper and traditional sparkling wine bottle shape.

[0098] FIG. 16 is a cross-section of another embodiment of the bottle closure shown in FIG. 15, shown with a reseal cap.

[0099] FIG. 17 is a side view of a stopper having a shape adapted for engagement by a cork pulling sleeve according to another aspect of the present invention.

[00100] FIG. 18 is a cross-section of a closure capsule for engaging a stopper, such as shown in FIG. 17 according to another aspect of the present invention.

[00101] FIG. 19 is a top view of the closure capsule of FIG. 18.

[00102] FIG. 20 is a partial cross-section of the closure capsule of FIG. 18 on a bottle according to another aspect of the present invention, and shown engaging a cork such as depicted in FIG. 17.

[00103] FIG. 21 is a detail view of the interface between the stopper of FIG. 17 and the engagement fingers of the closure capsule according to another aspect of the present invention.

~~[00104]~~ FIG. 22 is a cross-section of an alternative closure capsule according to another aspect of the present invention.

[00105] FIG. 23 is a partial cross-section of the closure capsule of FIG. 22, shown with a reseal cap engaged on the top of a bottle.

[00106] FIG. 24 is a side view of a stopper having an enlarged head according to another aspect of the present invention configured for being engaged by a closure capsule.

[00107] FIG. 25 is a top view of the stopper shown in FIG. 24.

[00108] FIG. 26 is a partial cross-section of a closure capsule according to another aspect of the present invention shown for engaging the stopper of FIG. 24.

[00109] FIG. 27 is a cross-section of a one-piece closure capsule according to

another aspect of the present invention shown with protrusions for attaching a short cork stopper.

[00110] FIG. 28 is a bottom view of the closure capsule of FIG. 27.

[00111] FIG. 29 is a cross-section of the one-piece closure capsule of FIG. 27, shown sealing a bottle.

[00112] FIG. 30 is a cross-section of a two-piece closure capsule according to another aspect of the present invention shown with a cap and plug assembly which are engaged by a sleeve.

[00113] FIG. 31 is a partial cross-section of the closure capsule of FIG. 30 showing the combination cap and plug separated from the sleeve.

[00114] FIG. 32 is a partial cross-section of a closure capsule having a molded polymeric plug according to another aspect of the present invention, shown with a cap which restrains uncontrolled plug egress.

[00115] FIG. 33 is a cross-section of an open-end plug according to another aspect of the present invention.

[00116] FIG. 34 is a cross-section of an open-top "H" shaped plug having a curving seal member according to another aspect of the present invention.

[00117] FIG. 35 is a cross-section of an open-top "H" shaped plug having a planar seal member according to another aspect of the present invention.

[00118] FIG. 36 is a cross-section of a long open-top closed-end plug according to another aspect of the present invention.

[00119] FIG. 37 is a cross-section of a short open-top closed-end plug according to another aspect of the present invention.

[00120] FIG. 38 is a cross-section of a two-piece plug having a head member joining to a sealing member according to another aspect of the present invention.

[00121] FIG. 39 is a cross-section of a one-piece closure capsule according to another aspect of the present invention, shown with a ringed plug integrated into the closure capsule.

[00122] FIG. 40 is a cross-section of a first dual-tapered bottle neck.

[00123] FIG. 41 is a cross-section of a second dual-tapered bottle neck.

[00124] FIG. 42 is a cross-section of a ringed polymeric plug being inserted within the first dual-tapered bottle neck depicted in FIG. 40.

[00125] FIG. 43 is a cross-section of a ringed polymeric plug being inserted within the second dual-tapered bottle neck depicted in FIG. 41.

[00126] FIG. 44 is a cross-section of a rotatable sleeve closure with tamper indication according to another embodiment of the present invention, shown with a planar seal retained beneath a cap joined to a threadable sleeve.

[00127] FIG. 45 is a detailed view of the rotatable sleeve closure of FIG. 44.

[00128] FIG. 46 is a cross-section of a straight-finger tamper-indication feature according to another aspect of the present invention.

[00129] FIG. 47 is a cross-section of a ratchet-finger tamper-indication feature according to another aspect of the present invention.

[00130] FIG. 48 is a cross-section of a closure capsule utilizing integral seals on the sleeve and a reseal cap according to another aspect of the present invention.

[00131] FIG. 49 is a cross-section of the closure capsule of FIG. 48 shown sealing a bottle.

[00132] FIG. 50 is a cross-section of a bottle sealed with the reseal cap shown in FIG. 49 after removal of the sleeve.

[00133] FIG. 51 is a detail view of a compliant seal and drip resistant edge according to another aspect of the present invention.

[00134] FIG. 52 is a cross-section of a one-piece separable closure capsule according to another aspect of the present invention, shown with capsule attached on a bottle.

[00135] FIG. 53 is a cross-section of the sleeve from the closure capsule of FIG. 52 shown slid up and engaging the bottle threads and providing a drip-resistant rim.

[00136] FIG. 54 is a cross-section of the reseal cap separated from the closure capsule of FIG. 52.

[00137] FIG. 55 is a cross-section of the one-piece capsule according to another aspect of the present invention, shown with a single planar seal.

[00138] FIG. 56 is a detail view of a compliant seal element as depicted in FIG. 55.

[00139] FIG. 57 is a cross-section of a one-piece capsule with a tamper-resist feature according to another aspect of the present invention, shown with locking fins engaging the choke ring.

[00140] FIG. 58 is a bottom view of the capsule shown in FIG. 57.

[00141] FIG. 59 is a cross-section of a closure capsule with a separate combination disk and plug member according to another aspect of the present invention.

[00142] FIG. 60 is an exploded cross-section of disk and plug member of FIG. 59, shown positioned for being engaged by the sleeve of the closure capsule onto the bottle.

[00143] FIG. 61 is a side view of a bottle neck having a locking ring for use with a tamper-indication feature according to another aspect of the present invention.

[00144] FIG. 62 is a cross-section of a closure capsule with separable bottom ring according to another aspect of the present invention, shown engaged on the bottle.

[00145] FIG. 63 is a detail view of the closure capsule of FIG. 62 engaged with the bottle.

[00146] FIG. 64 is a bottom view of the closure capsule of FIG. 63 showing engagement tabs.

[00147] FIG. 65 is a side view of the sealed bottle having the closure capsule of FIG. 62 surrounding the bottle of FIG. 61.

[00148] FIG. 66 is a side view of a bottle configured for retaining a sleeve upon the neck of a bottle according to another aspect of the present invention, shown with engagement protrusions extending near the base of the bottle neck.

[00149] FIG. 67 is a side view of the bottle neck of FIG. 66 upon which a closure capsule is engaged, according to an aspect of the present invention.

[00150] FIG. 68 is a side view of a bottle neck having a retention recess

according to another aspect of the present invention.

[00151] FIG. 69 is a partial cross-section of the bottle depicted in FIG. 68 shown surrounded by a closure capsule engaged with the retention recess.

[00152] FIG. 70 is a detail view of the retention recess of FIG. 68 engaged with a protrusion on the sleeve of a closure capsule.

[00153] FIG. 71 is a cross-section of a stopper according to another embodiment of the present invention, showing a two-piece stopper having a rigid frame and soft elastic outer layer.

[00154] FIG. 72 is a cross-section of a stopper according to another embodiment of the present invention, showing a short two-piece rigid frame stopper which incorporates a planar bottle top seal.

[00155] FIG. 73 is a side view of a bottle configured to accept a threaded closure capsule according to an embodiment of the present invention showing a choke ring and recessed portion of the neck.

[00156] FIG. 74 is a side view of a Bordeaux style bottle pattern.

[00157] FIG. 75 is a side view of a Rubato style bottle pattern.

[00158] FIG. 76 is a side view of a Burgundy style bottle pattern.

DETAILED DESCRIPTION OF THE INVENTION

[00159] The present invention is an improved apparatus for opening and sealing a bottle. Referring more specifically to the drawings, for illustrative purposes the present invention is embodied in the apparatus generally shown in FIG. 1 through FIG. 76. It will be appreciated that the apparatus may vary as to configuration and as to details of the parts, and that the method may vary as to the specific steps and sequence, without departing from the basic concepts as disclosed herein.

[00160] The present invention comprises several new closure designs that have been divided into four (4) functional types, as outlined in Table 1. The first type (Type 1) and third types (Type 3) are for non-pressurized fluids (or fluids that are only slightly pressurized), such as wine or juice, while the second (Type 2) and fourth types (Type 4) are for pressurized fluids, such as champagne, sparkling wines, and sparkling juice. Type 1 and Type 2 utilize

natural cork sealing elements while Type 3 and Type 4 closure types utilize synthetic sealing elements, such as cork-like stoppers, shorter plugs, planar seals, and bead seals. It should be appreciated that although still wine (non-pressurized) could be contained in Type 2 closure products, this would generally not be as cost effective as closure solutions described for still wines. Table 2 lists the usage of various embodiments described and shown in the figures with the type of closure, whether a traditional (natural) cork is utilized, and whether the cork is pulled with an anchor.

[00161] The four general types of bottle closures are discussed in detail in the following materials. A bottle closure design designator will be referred to in association with the embodiments described and shown in the drawings, the designator is not associated with the figure numbering within the present application and is to be considered only for the purposes of correlating descriptive elements with specific designs as shown in the drawings. Table 2 lists these design reference numbers along with the associated figure number where described, the type of closure, whether it utilizes a cork, and whether it utilizes an anchor.

[00162] FIG. 1 through FIG. 10 exemplify the use of multi-part cork anchors within Type 1 closures. It should be appreciated that although natural cork or synthetic cork is typical, stoppers may be formed from alternative materials without departing from the teachings of the present invention. The use of one-piece cork anchors for Type 1 closures will be referred to herein generally as Type A anchors, while multipart anchors described in the present invention will generally be referred to as Type B anchors. A number of new Type 1 cork-type closure designs are described. The use of a multipart anchor brings with it a host of advantages, not the least of which is in relation to the bottling process. These closures generally comprise a shank member which is engaged by a head member during the bottling process and a means for converting a rotational torque to an axial cork-extraction force.

[00163] Instead of inserting an anchor into the stopper during the bottling process as with Type A anchors, the anchor shanks of Type B anchors can be

pre-inserted into stoppers prior to delivery to the winery, wherein additional anchor parts are then coupled to the anchor shank in response to assembling the closure capsule, or a portion thereof, to the bottle after sealing. For many bottling applications this aspect of multipart anchoring provides important benefits over the insertion of one-piece anchors into stoppers during bottling, such as at a winery. Furthermore, use of multipart anchoring removes a higher risk operation out of the bottling line and puts it where tighter controls and better quality can be maintained, and in which much higher failure rates can be tolerated. The use of multipart anchors substantially reduces requirements for modifying bottling lines and purchasing additional equipment at the bottling facilities.

[00164] In utilizing a multipart anchor, a stopper with pre-inserted anchor shank is compressed and installed to seal the bottle. An anchor head (of one or more elements) is afterward secured onto the anchor shank, such as part of a closure capsule. Another advantage of this multipart approach is that the anchor head, with optional reseal cap, can be preassembled into a closure capsule that can be applied to the corked bottle on the bottling line in a single operation where the closure capsule assembly is simply twisted down onto the bottle neck upon which the anchor head latches onto the anchor shank. Multipart anchors are represented in the figures which are called out as Design 46, Design 51 and Design 52.

[00165] FIG. 1 through FIG. 3 exemplify a multi-part anchor system 10 that utilizes a socket for connecting the anchor shank to the anchor head. This specific embodiment is referred to herein as Design 51, and is shown by way of example and not of limitation. A stopper 12, preferably a natural or synthetic cork, is shown inserted into bottle 14. The upper portion of the bottle preferably has a narrowed region N within the corkage area over which the closure capsule will be received.

[00166] The narrowed region N is shown surrounded by an elongate threaded sleeve portion of closure capsule 16. Exterior threads 18 protrude from the neck of bottle 14, preferably proximal to the top of bottle 14. The bottle is

shown with a recessed "choke" ring R which facilitates grasping of the bottle (i.e. during bottle manufacturing). The narrow neck portion N is configured to receive sleeve closure capsule 16 so that the exterior of the sleeve portion of the capsule can follow the bottle contour, which allow effectively duplicating the look of traditionally wrapped foil-finished bottle necks.

[00167] Threads 18 extending from a portion of the bottle neck exterior are shown engaging threads 20 on the interior of closure capsule 16. Rotation of capsule 16 on bottle 14 in a first direction, preferably counterclockwise (when viewed looking down at the top of the bottle), results in movement of the capsule 16 upward and away from the top of the bottle, while rotation in the opposing direction tightens the threaded capsule down onto the bottle neck. It should be appreciated that the lower portion of capsule 16 with tapered interior T preferably forms a smooth transition with bottle 14. The combination of narrowed neck N overwrapped by closure capsule 16 provides the conventional appearance of a foil-wrapped bottle, or other desired aesthetic attributes, while providing the convenience of a twist-opening bottle closure.

[00168] An anchor shank 22 is shown embedded into stopper 12, such as with its retention threads 24 extending sufficiently far into material of the stopper to ensure that axial upward force applied to the top of the anchor shank will result in stopper removal and not removal of anchor shank 22 from the stopper. It should be appreciated that anchor shank 22 may be retained within stopper 12 utilizing alternative means for retaining the anchor within the cork, such as barbed protrusions, one-way flexed protrusions, or other forms of retention protrusions, injection of molten anchor material into an aperture in the stopper to form anchor in-situ, adhesives to retain the anchor shank, and various combinations thereof, without departing from the teachings of the present invention.

[00169] A preferred embodiment of the Type B anchor has a distal end 26 of anchor shank 22 embedded in a stopper of cork material while preferably not extending through the sides or bottom of stopper 12. A proximal end 28 of anchor shank 22 terminates in a connection means configured for being

engaged by the anchor head. By way of example, the connection means comprises a socket 30 on the proximal end of the anchor shank configured for being engaged by the flared tip 32 of a stud 34 extending from the bottom of anchor head 36.

[00170] During stopper removal engagement lip 38 of closure capsule 16 axially drives anchor head 36 along with attached anchor shank 22 upwardly to pull stopper 12 from the neck of bottle 14 in response to the rotation of closure capsule 16. It should be noted that capsule 16 may be rotated without applying a significant torque upon stopper 12, except that required to overcome friction between adjacent parts that can move relative to each other. This beneficially reduces the torque necessary for opening the bottle, in that the torque applied to sleeve 16 is converted under mechanical advantage to an axial extraction force without the need for additional torque, supplied at no mechanical advantage, for rotating the stopper. This means of providing axial coupling without concomitant rotational coupling may comprise configuring engagement lip 38 to slip when in rotating contact against anchor head 36, and preferably configuring the interface of stud 34 of anchor head 36 to slip when in rotating contact with socket 30. It should also be appreciated that these rotational slip arrangements do not alter the extent of engagement between the anchor head and anchor shank, a problem which could arise for example if a threaded coupling were utilized between the anchor head and shank that could lead to disengagement or stopper damage.

[00171] It should be appreciated that once the stopper has been removed, at least the sleeve portion of the capsule may generally be threaded back down onto the bottle to retain the aesthetics of the bottle neck and to pad the neck of the bottle to simplify pouring bottle contents without chipping or breaking delicate wine glasses and to reduce dripping during pouring. It should, however, be appreciated that in certain applications it may be desirable to limit the direction of rotation of the pulling sleeve or to prevent it from being rethreaded fully onto the bottle neck, such as for providing an indicator of a compromised seal.

[00172] FIG. 2 and FIG. 3 show more details of anchor shank 22 for the two-part anchored closure of Design 51. An optional flange 40 is shown surrounding the proximal end 28 of anchor shank 22 which increases the liquid-tight seal with the stopper, reduces oxygen ingress into the stopper, and provides an insertion depth reference that can assure that anchor shank 22 is always inserted to the proper depth within stopper 12.

[00173] A means for engaging anchor shank 22 for driving it into stopper 12, under axial and rotational urging, is shown implemented as a drive coupling 42 exemplified as a polygonal recess in the head of anchor shank 22, such as a hexagon, into which a tool may be inserted for driving anchor shank 22 into stopper 12. It should be appreciated that drive coupling 40 may be implemented using any convenient form of mechanical coupling, such as known to one of ordinary skill in the art, without departing from the teachings of the present invention. Drive coupling means 40 may comprise any recessed or protrusion capable of being engaged, such as a polygon shape, and may include other means of engagement such as a Torx drive, Phillips drive, or any other form of drive engagement mechanism. An anchor socket 44 is shown with an underlying cavity 48 for securely engaging the tip 32 of stud 34 extending down from anchor head 36. Anchor socket 44 is depicted as a generally circular opening with a stress relieving notch 46 rendering the opening sufficiently compliant for the tip 32 of stud 34 to snap into anchor socket 44 (i.e. during bottling) and be retained within cavity 48.

[00174] Type B anchors are to be generally applied as follows. An anchor-shank 22 is driven into a prepared stopper, typically a cork stopper, (such as having an appropriately sized aperture created for receiving the anchor shank and optionally inserting a sealing liquid or gel) to create a stopper that is ready for use during bottling. Anchor-shank 22 may be driven into the stopper utilizing drive coupling 42 or other drive coupling means. It is preferred that preparation of the stopper with the anchor-shanks is a side operation, not to be performed on the bottling line. In this way, the bottling line is not affected by any anchor insertion failures, and the anchor insertion process can take

place in a more carefully controlled environment than on the bottling line. During bottling, a stopper with a pre-installed anchor is inserted into the neck of the bottle to a sufficient depth, typically with the top of the stopper and/or anchor being approximately flush with the top of the bottle. A pre-assembled B type closure capsule including an anchor-head and optional cap assembly is spun down onto the bottle, wherein the anchor head engages and locks onto the anchor shank of the installed stopper. It should be appreciated that after the mechanically locked engagement occurs between the anchor head and anchor shank, that the Type B anchor design operates in substantially the same manner as a Type A anchor design.

[00175] A number of benefits can be derived from the use of Type B anchors, including the following, which are provided by way of example: the reduction of components to be installed on the bottling line from three separate items for a Type A anchor, to just one assembly of components for a Type B anchor, and the reduction in the necessary application equipment required at the bottling facility (i.e. winery) from three new machines for installing Type A anchors to just one new machine needed to install Type B anchors on the bottling line. It is contemplated that the use of Type B anchors prepared outside of the bottling line, such as by third-party stopper suppliers, can raise the overall confidence level with utilizing this form of bottle closures and shift the risk of application failures from winery bottling lines to stopper suppliers.

[00176] By way of further example, the Type B anchors are exemplified within additional closures, Design 46 and Design 52. Design 46 reverses the stud to receptacle interface described for Design 51.

[00177] FIG. 4 through FIG. 8 exemplify a stopper anchor 50, of Design 46 which is a Type B multipart anchor shown retained within the neck of a bottle. A stopper 12 is shown within the neck 14 of a bottle, with the sleeve portion of a closure capsule 16 shown surrounding the narrowed exterior N of the neck of bottle 14 wherein threads 18 on the exterior of at least a portion of the bottle neck engage threads 20 on the interior of closure capsule 16. The base of the sleeve portion of closure capsule 16 is shown with an inside taper T

that is adapted to provide a smooth transition with the exterior of the bottle. It should be appreciated that this taper may be employed on the various embodiments of the present invention, and can provide the look of a foil wrapped bottle.

[00178] A recessed "choke" ring R is also shown beneath exterior threads 18 to allow grasping of bottle 14 by tooling, such as during bottle manufacturing. Anchor shank 52 having stopper engagement means, depicted as threads 54, is shown secured within stopper 12 with a distal end 56. The stopper engagement means, such as threads 54, and distal end 56 are preferably configured to be retained within stopper 12 without protruding through either the sides or bottom of stopper 12.

[00179] A proximal end 58 of anchor shank 52 is shown as an exterior-engaged coupling 60 that extends from the top end of stopper 12. Exterior-engaged coupling 60 may comprise any desired shape, such as a polygon, or it may otherwise incorporate exterior protrusions or apertures configured for being engaged by a tool for driving anchor shank 52 into stopper 12. By way of example, exterior-engaged coupling 60 of anchor shank 52 is preferably configured with three to six sides that may be engaged by a nut-driver style tool for driving anchor shank 52 into stopper 12.

[00180] Extending from the proximal end 58 of anchor shank 52 is a protrusion, such as a stud 62 extending from coupling 60, configured for engaging an anchor head 64. An engagement means between the protrusion and anchor head is exemplified as ribs 66, shown in a preferred radially symmetric configuration as a series of small frustoconical surfaces similar to a hose barb, which preferably comprise an integral portion of the anchor shank. These ribbed protrusions are received within a mating receptacle 68 in anchor head 64. The figure depicts the use of a mating receptacle 68 having a triangular cross section that "catches" on the ribs of the male stud 62 when it is inserted into the female receptacle to "lock" in place for withstanding axial stopper extraction forces. The receptacle 68 within female anchor head 64 is preferably configured with hinged fingers 70a, 70b, 70c, with teeth for

engaging stud 62, such as similar to the retention geometries utilized within common nylon cable ties, "Tie wraps", or similar devices. Hinges 72, preferably at the base of hinged fingers 70a - 70c, allow the fingers to be deflected in response to insertion of the anchor stud 62. The mating between stud 62 and receptacle 68 could be generally thought of as comprising three cable ties arranged in a triangle. Teeth on each of the three fingers, (three teeth are depicted) are always engaged with the stud. The shape of these teeth differs from flat tie wrap fingers because they must be curved where they mate with the stud, yet they still must hinge about a line. The length of the stud is sufficient to accommodate variations in the vertical positioning of the stopper within the bottle neck. In this way the stud will engage the receptacle regardless of the stopper and/or anchor being positioned slightly higher or lower than its nominal position. The length of the stud preferably accommodates a positional variation of at least two millimeters and more preferably a variation of up to plus or minus two millimeters (four millimeters variation). It should be appreciated that anchor head 64 is configured to rotate about stud 62 so that any rotational urging applied to anchor head 64 does not force rotation of stopper 12 within bottle 14. The coupling 60 also is configured for being engaged by a tool for driving anchor shank 52 into stopper 12 in response to applied axial and rotational forces for advancing the threads of the anchor shank 52 into stopper 12.

[00181] Also seen in the figures are a cap 74 with seal 76, said cap shown stored with its periphery engaged in an annular recess 78 within closure capsule 16. It will be appreciated that inclusion of such a cap provides an optional benefit that can increase seal integrity, improve aesthetic appeal, and provide a ready means of temporarily sealing the bottle top once the stopper (or other form of stopper) has been removed. A recess 80 is shown in cap 74 adapted to a shape to fulfill aesthetic and/or packaging considerations. For example, recess 80 may be adapted into a shape wherein the bottle end appears similar to a traditional foil-wrapped bottle, or may be adapted with a logo, embossed emblem, or other elements, especially trade dress elements.

It should be noted that recess 80 and its associated use for trade dress, such as for logos and so forth, can be generally applied to all closure capsule embodiments described within the present invention.

[00182] FIG. 7 and FIG. 8 illustrate the interlocking of (compliant) fingers 70a - 70c with ribs 66 are coupled through hinge 72 to engage ribs 66 on stud 62. The use of these hinged fingers and ribs provide a number of benefits, including (1) reducing the insertion force required as the parts engage one another, and (2) gripping the stud with increased force in a direction opposing an applied axial cork-removal force. The axial force is shown in the figure as ***F*** (this is the force necessary for removing the stopper from the bottle). The horizontal component of the reaction force at the hinge is shown as force ***F1***, which represents the gripping force which maintains the teeth in full contact under load. FIG. 7 graphically depicts the loading of one finger, while FIG. 8 is a simplified free body diagram of the finger.

[00183] FIG. 9 and 10 illustrate another Type B closure 90 utilizing a multipart anchored stopper having a split engagement stud, referred to as Design 52. Anchor shank 92 with protruding threads 94 (or other stopper engagement means) has a distal end 96 and proximal end 98 shown engaged within stopper 12 within the neck of a bottle 14, which is surrounded by a closure capsule 16. The interior of the base of closure capsule 16 is tapered T to conform to the exterior of the bottle where it transitions into the narrowed portion N of the neck configured for receiving the capsule. Threads 18 protrude from the neck of bottle 14 for engaging closure capsule 16. A recessed choke ring R is exemplified beneath protruding threads 18 to facilitate grasping of the bottle by tooling, such as during bottle manufacture.

[00184] An automatic insertion coupling 100 is shown in contact with the top of the stopper and configured for being engaged by a tool for driving anchor shank 92 into the stopper in response to applied axial and rotational forces for advancing the threads of anchor shank 92 into stopper 12 (i.e. a cork stopper). A split stud 102, with slot 104, is shown extending from coupling 100 for engaging an anchor head 106. It should be appreciated that slot 104

on split stud 102 provides a measure of engagement compliance, because the sides of stud 102 can flex inwardly in response to a sufficient applied force during engagement.

[00185] FIG. 10 depicts a view of the anchor head 106 having a recess 108 with aperture 110 for receiving split stud 102. As a consequence of the compliance in split stud 102, the receptacle for connecting with stud 102 may be implemented as a simple aperture 110, although more complex forms may be similarly utilized. A radially symmetric female head is preferably utilized to catch the split male stud 102. As anchor head 106 is applied to engage split stud 102, the slot 104 deflects to allow engagement, while the female anchor head 106 generally retains its shape with preferably one or more fixed teeth engaging portions of split stud 102.

[00186] FIG. 11 through FIG. 16 exemplify embodiments of Type 2 closure designs according to the present invention which are particularly well suited for use on sparkling wines, champagnes, beers, or other pressurized fluids. It should be appreciated that some forms of beers or similar beverages are bottled in a manner similar to that of sparkling wine or champagne. These designs include a safety mechanism which retains the stopper (typically cork) during storage and shipping and prevents uncontrolled explosive egress of the stopper from the bottle which poses a safety hazard when utilizing conventional closures on pressurized bottles. These closure designs each utilize a closure capsule which engages exterior bottle threads for providing stopper pulling leverage during stopper removal, although the designs differ from each other in other important regards, such as how the stopper is prevented from unrestricted egress.

[00187] Embodiments of these Type 2 closures are implemented following many traditional aspects of pressurized fluids, such as sparkling wines, including for instance the use of heavier (thicker-walled) glass than required for still wines (or fluids), a crown cap rim at the top of the bottle for use in the fermenting process, and a large flange for use in the bottling process. The Type 2 closures according to the present invention may utilize either single

piece anchors (Type A) or multipiece anchors (Type B) without departing from the teachings herein.

[00188] FIG. 11 through FIG. 14 exemplify a Type 2 pressurized closure 130 referred to as Design 20 shown sealing a glass bottle 132 having sufficient thickness to withstand the maximum pressure of the filled bottle, which necks down to a narrowed region 134 configured to receive closure capsule 136, which is also referred to herein as a "capsule". Threads 138 on the exterior of the neck of bottle 132 engage the interior thread 140 of capsule 136 during stopper extraction. An annular recess R beneath threads 138 facilitate grasping of the bottle by tooling, such as during bottle manufacturing.

[00189] Closure 130 utilizes a nominally cylindrical stopper element 142 (natural or synthetic) that is substantially fully inserted into the bottle during sealing, with no traditionally bulbous portion extending above the bottle. It will be appreciated that traditional champagne and sparkling wine corks are initially cylindrical with a portion of the stopper (approximately 0.75 inches) protruding from the bottle after corking. In a traditional pressurized champagne or sparkling wine closure, the top portion of the stopper is not compressed by the bottle and generally forms a "bulb" on the top of the bottle that traditionally is manually grasped and manipulated to force stopper extraction.

[00190] FIG. 11 depicts closure 130 with a stopper element 142 into which an anchor 144 is engaged with anchor head 146. It should be noted that the length of stopper portion 142 inserted into bottle 132 is typically less than the length of stoppers utilized for Type 1, non-pressurized, closures. Type 2 anchor 144 is preferably shorter than a Type 1 anchor to accommodate a shorter than traditional stopper insertion length. Closure 130 is similar in many respects to Type 1 closures described earlier, with some notable exceptions.

[00191] It will be appreciated that the inside diameter 150 of closure capsule 148 extending above the bottle is preferably smaller than the outside diameter of the stopper to prevent unrestrained egress of stopper 142 from the bottle,

thereby ensuring that stopper travel from the bottle is limited by the movement of capsule 148. This necked-down diameter 150 of the cork-pulling capsule 148 prevents uncontrolled explosive stopper egress during stopper removal.

[00192] An optional cap 152 with seal liner 154 (or other seal fitment) is shown retained in closure capsule 148, such as may be utilized for resealing the bottle after removal of the capsule with attached cork. A means for grasping cap 152 is shown provided by way of decorative access notches 156 allowing the user to grasp and rotate the cap, while providing a desired stylish external shape. It will be appreciated that other configurations of cap 152 and sleeve 148 can be utilized so that the cap may be grasped for removal and use, for example annular portions extending above the sleeve of capsule 136, incorporating tear-away portions on the top of sleeve 148, including manual engagement structures within the cap, and similar adaptations which should be obvious to one skilled in the art in view of the teachings herein.

[00193] It should be appreciated that the stopper with embedded anchor within this embodiment is generally inseparable from the capsule (sleeve) as a consequence of the stopper retention feature of the capsule (notwithstanding manually unscrewing stopper 142 from shank 144). It may be preferable in some applications to configure cap 152 so that it cannot be removed from closure capsule 148, such as by bonding it to the capsule.

[00194] It will be appreciated that during use, as capsule 148 is rotated and stopper 142 is extracted from bottle 132, capsule 148 is still threadably engaged with bottle 132. It is preferable that the length of engagement between the threaded portion 138 of capsule 138 and the bottle be in excess of that required to disengage the stopper. For example the capsule remaining engaged with the bottle for at least one-half revolution, or more preferably at least approximately one full revolution, in excess of the length required to extract the stopper. It should be appreciated that the length of engagement should be sufficient, despite variations in stopper size and mounting, for the threadably engaged capsule to restrain the stopper to prevent unrestricted, explosive, egress of the cork. Thus, the stopper is retained by the capsule as

it is extracted from the bottle thereby preventing the stopper from becoming a projectile. The threaded length for this Type 2 closure is thereby preferably about the same as for still wine because the stopper in sparkling wine bottles extends only about one inch (1.0") into the bottle, whereas it traditionally extends from one and one half, to two inches (1.5" to 2.0") into the bottles of still wine.

[00195] FIG. 12 through FIG. 14 illustrate outside geometries for a capsule, Design 20, which can be tailored in shape in order to resemble the traditional look of a foil-covered cork-sealed bottle of sparkling wine, and/or champagne. FIG. 12 and FIG. 13 depict views of a sealed bottle, while FIG. 14 depicts a capsule removed from the bottle. The function of the reseal cap, with liner or fitment, fulfills the same need as reseal caps described for use with still wine. FIG. 12 through FIG. 14 depict the capsule with a scalloped feature 156 to aid in removing the reseal cap from the capsule.

[00196] Other variations of the reseal cap, with liner or fitment, may be implemented with a fully or partially exposed reseal cap, wherein the reseal cap protrudes from the capsule to be easily gripped by consumers when removing it from the capsule. The cap can be configured to allow removal prior to uncorking of the bottle. The cap may snap into the capsule, be threadably engaged therein, or be temporarily retained by other means prior to being removed and threadably engaged for resealing the top of the bottle.

[00197] FIG. 15 and FIG. 16 depict embodiments of Type 2 closures according to the invention which are implemented without the use of stopper anchors, although they may utilize a conventional stopper (shown in phantom) for sealing the bottle, such as a champagne cork. FIG. 15 depicts a closure 170 particularly well suited for pressurized fluids, that is referred to as Design 28, with a bulbous stopper portion extending above the bottle as found in traditional champagne and sparkling wine products. A bottle 172 is shown with narrowed neck 174 and engagement ring 176, beneath which is formed a ledge leading to an annular recessed portion R which may be grasped by tooling during bottle manufacture. Engagement ring 176 is configured with

external threads 178 over which a closure capsule 180 is threaded having internal threads 182 and stopper engagement means, such as extraction flange 184, as shown. The base of capsule 180 is preferably configured with an interior taper T for fitting capsule 180 to the contour of the bottle exterior. Extraction flange 184 is configured having an aperture smaller than the bulbous top portion 188 of stopper 186 which extends above the top of bottle 172.

[00198] The bottling sequence generally comprises threading capsule 180 onto bottle 172 until flange 184 is positioned for stopper engagement. The lower portion of stopper 188 is then compressed during insertion into bottle 172, with the bulbous uncompressed portion 188 protruding above the bottle. A cap 190 is then joined to capsule 180, such as within a recess 192.

[00199] Preferably cap 190 is permanently retained by capsule 180 for restricting the egress of stopper 186, and thereby preventing a stopper from becoming a projectile. Cap 190 is shown threadably engaged with capsule 180, although it may be additionally, or alternatively, attached by thermal welding, adhesive bonding, snapping, or any other convenient form of retention. Cap 190 is shown formed from plastic, although it may be alternatively formed as a wire cage, netting, or any other convenient form capable of retaining the stopper from uncontrolled egress. As the closure is rotated and the stopper is pulled out of the bottle, the capsule remains engaged with the bottle. Permanent retention of cap 190 onto capsule 180 results in holding the stopper in place on the bottle during storage and prevents accidental removal of the cap, which would otherwise allow uncontrolled explosive stopper egress from the bottle.

[00200] It should be appreciated that cap 190 may alternatively be removably retained on capsule 180, such as for use as a reseal cap. To assure controlled stopper egress it may be beneficial to prevent the user from removing cap 190 from capsule 180 prior to removal of capsule 180 from bottle 172. Capsule 180 may be configured with a means to lock cap 190 in place until the stopper is removed, such as utilizing a compression mode

which applies an outward radial pressure when capsule 180 is threadably engaged on bottle 172 to engage vertical ridges peripheral to cap 190 with vertical ridges within the recess 192 of the capsule. As a result, capsule 190 may be removed from bottle 172 only after the capsule is at least partially threaded off of bottle 172, thereby releasing the engagement between the interlocking vertical ridges.

[00201] The length of engagement of the threaded portion of the capsule and bottle should be at least approximately one half of a rotation, or more preferably approximately one full rotation beyond the extension required to unseal the stopper from the bottle. It will be appreciated that the interface may be configured to require additional turns prior to removal; however, reducing the amount of turns below the one half turn could result in uncontrolled stopper egress with sufficient variation in stopper insertion or size. Thus the stopper is retained while being extracted to prevent the stopper from becoming a projectile due to the explosive exit force resulting from the pressure inside the bottle.

[00202] The outside dimensions of the capsule as mentioned previously can be tailored in shape for aesthetic purposes, such as to resemble the traditional look of a foil covered sparkling wine bottle. One particularly attractive design fabricates the capsule and cap from transparent (clear or tinted) polycarbonate in order to display high quality corks with promotional emblems or printing. It should be appreciated that the use of transparent elements (clear or tinted) to allow viewing of elements underneath is a feature that may be applied to all of the closure capsules, or portions thereof, described within the present invention.

[00203] FIG. 16 exemplifies an additional Type 2 closure 210 having a separate reseal cap, and which is referred to as Design 54. Cap 190 of FIG. 15 is adapted in FIG. 16 as a cap 212 that includes a reseal cap retainer structure 214, for storing reseal cap 216 prior to uncorking the bottle. Reseal cap 216 preferably having a planar seal or fitment 218 (i.e. flat, shaped, and/or plug style) for engaging the opening in the bottle to prevent the pressurized

contents from going "flat" after it is resealed with this cap.

[00204] FIG. 17 through FIG. 26 exemplify a closure utilizing a stopper similar to that of FIG. 15 and FIG. 16 in that the stopper is configured with an extraction engagement structure that may be engaged by the closure capsule. The closure is preferably implemented as a Type 3 closure utilizing a synthetic stopper material; however, it may be configured as a Type 1 closure if a sufficiently robust natural cork material is utilized or the natural cork material is structurally augmented in some manner to provide sufficient strength. The inclusion of a grasping structure on the stopper eliminates the need for a stopper anchor. This style of closure can be implemented in a number of different ways.

[00205] In a first approach the closure capsule is joined to the bottle prior to insertion of the cork, while in a second approach the stopper is inserted prior to joining the closure capsule. The closure capsule is preferably configured with stopper grasping structure that engages the extraction engagement structure integral with the stopper in a unidirectional manner for extracting the stopper element.

[00206] FIG. 17 exemplifies a stopper 230 whose extraction engagement structure 232 comprises a recessed area, preferably an annular recess, near the top of the cork, which is configured to protrude above the bottle top when the stopper seals the bottle neck opening. FIG. 18 and FIG. 19 illustrate a closure capsule 234 comprising sleeve 236, head portion 238 and stopper grasping structure 240 which is configured to engage stopper 230 for extraction and which surrounds opening 242 as seen in FIG. 19. Closure capsule 234 is configured for being received on a bottle 244 shown in FIG. 20, into which stopper 230 has already been inserted. The interior of the base of closure capsule 234 is tapered T to fit the exterior of the bottle. As closure capsule 234 is fitted to a corked bottle, protrusions within grasping structure 240 flex to allow the capsule to pass down over the top portion of the stopper with minimal force. Once engaged within the extraction engagement structure 232, these same protrusions engage the stopper to prevent stopper

movement in the opposing direction. FIG. 20 depicts the closure capsule after being fully threaded down onto bottle 244.

[00207] An optional cap 246 is shown engaged within a recess at the top of head portion 238. Cap 246 may be configured to provide a secondary seal (the cork or other form of stopper providing the primary seal) to keep oxygen out of the wine and to keep the wine from leaking out of the package, in the event that the stopper leaks or allows oxygen migration into the wine. A variety of sealing mechanisms may be utilized separately or in combination, including integrated sealing protrusions, o-rings, flexible fins, soft sealant compounds, sealant layers, and combinations thereof.

[00208] FIG. 21 is a detailed view of an engagement finger 248 with a hinged base 250 and stopper engagement notch 252 shown engaging the portion of the stopper 230 on the upper portion of extraction engagement structure 232. Engagement finger 248 can deflect toward the exterior of closure capsule 234 as the capsule is threaded down on the bottle and over the protruding portion of stopper 230. However, once fitted on the bottle as shown in FIG. 20 and FIG. 21, it will be appreciated that threading off of capsule 234 from bottle 244 will result in simultaneous extraction of stopper 230 from bottle 244. It should also be appreciated that although a recess or other graspable structure is preferred on stopper 230, that engagement fingers 240 may be configured for sufficiently grasping the uncompressed exterior of a conventionally shaped stopper to extract it in response to unthreading of the closure capsule from the bottle. Preferably, engagement fingers 248 are configured to rotate about stopper 230 under the axial force applied by the rotation of capsule 234 without applying a substantial torque upon stopper 230. The rotational slippage of fingers 248 about stopper 230 reduces the amount of torque required of the user for opening the bottle while eliminating the need to increase the strength of finger 248 structures to withstand the torque.

[00209] FIG. 22 and FIG. 23 depict another embodiment of a closure capsule 270 which in this case is threaded down onto the bottle prior to stopper insertion. Closure capsule 270 comprises a sleeve 272, with head portion

274 within which are disposed engagement fingers 276. FIG. 23 depicts closure capsule 270 threaded onto bottle 278 having external threads 280, after the insertion of stopper 282. The closure capsule is shown after the application of reseal cap 284 with under-cap seal 286, into recess 288 on capsule 270 for storage on the bottle prior to use after the bottle is uncorked. Threads 280 on the exterior of bottle 278 are fully engaged with threads 290 on the interior of sleeve 272. A choke ring R is depicted on bottle 278 to facilitate bottle manufacture. Sleeve 272 of capsule 270 is disposed within the narrowed portion N of the bottle neck and is preferably configured with the base of sleeve 272 being tapered T to fit the exterior of the bottle at the transition to the narrowed portion N to simulate the appearance of a foil-wrapped bottle. It will be appreciated that the shape of engagement fingers 276 is configured to allow the stopper to be inserted up to the recess in the cork, whose edge is engaged by engagement fingers 276, restraining further stopper motion and allowing the stopper to be extracted when closure capsule 270 is threaded off, unscrewed, from bottle 278.

[00210] FIG. 24 through FIG. 26 exemplify an alternative embodiment of engaging a cork, wherein a protruding element at the top of the stopper is engaged during stopper extraction. A stopper 310 is shown by way of example having a cap piece 312 as seen in FIG. 24 and FIG. 25. Cap piece 312 of stopper 310 preferably is adapted with indentations about its periphery which simplify threading on a capsule over a bottle containing stopper 310. Preferably, stopper 310 is a synthetic cork or polymer-based stopper. Stopper 310 with cap 312 is depicted inserted within bottle 314 in FIG. 26 over which closure capsule 316 has been threaded. A head portion 318 of capsule 316 contains a plurality of engagement fingers 320 configured for being slid over cap 312 of stopper 310 to engage the underside surface for stopper extraction.

[00211] Cap 312 on stopper 310 may be modified in alternative ways to deform so that the cap portion of the stopper passes through the capsule as the capsule is threaded down onto the bottle neck, but that does not allow the cap

of the stopper to pass through the capsule again when the capsule is unscrewed. Moreover, the cap of the stopper preferably provides an adequate seat for being engaged by the top of the capsule during stopper extraction.

[00212] It should be appreciated that with any of the described approaches, the stopper and cap configuration must be compatible with the stopper installation process. A typical stopper installation utilizes a cylindrical compression sleeve that compresses the stopper (stopper) before it is pushed into the bottle, and involves a substantial axial force applied to the top of the stopper to push the stopper into the bottle. It should also be appreciated that in these modified synthetic stoppers, the entire stopper can be homogeneous, formed of joined elements, or be molded around an extraction engagement structure or anchor structure without departing from the teachings of the present invention.

[00213] When the closure capsule is twisted on before the stopper is installed, the top inside of the capsule should include a sealing fin that is pressure fitted against the top outside of the bottle as the capsule is twisted down onto the bottle, to maintain a seal in the presence of the vacuum that is pulled during stopper insertion. Then the modified top of the stopper need only provide a place for the capsule to push up against and provide sufficient strength to tolerate approximately one-hundred fifty pounds (150 lbs) of axial force. It should be noted that the twisting motion of the capsule can either cause the capsule to slip relative to the stopper or to turn the stopper within the bottle, or a combination thereof, any of which can be supported by these designs. It should be appreciated, however, as with other embodiments described herein, that it is generally preferable that the capsule be allowed to rotate independently of the cork, whereby only the axial displacement of the sleeve is translated to the stopper during extraction.

[00214] FIG. 27 through FIG. 31 depict embodiments of Type 3 closures according to the invention which are preferably implemented as synthetic closure designs. The Type 3 synthetic closures are particularly well suited for

use with still wines, or slightly pressurized fluids. The synthetic closure application may also be referred to as a cork-free design. These Type 3 designs provide a seal by insertion of a synthetic plug into the bottle neck that resembles a short non-compressed cork, or "bartop" cork. Bartop corks are typically inserted without being compressed first in a corking machine. The Type 3 closures may be implemented on closures having synthetic plug-type sealing elements, or according to numerous variations of the bartop cork following the inventive principles.

[00215] FIG. 27, FIG. 28 and FIG. 29 exemplify an embodiment of a closure capsule 330 with a "bartop" cork alternative referred to herein as Design 45. Preferably, this design and all its variations result in a closure comprising a single piece both before and after installation. As with other designs of the present invention, a threaded outer sleeve of the closure capsule is configured to overwrap a narrowed portion N along the bottle neck having external threading, and preferably also configured with a choke ring R. It is preferred that the base of the closure capsule have an interior taper T for conforming to the bottle exterior when threaded down on the bottle neck, which can provide the appearance of a foil-finished bottle.

[00216] FIG. 27 and FIG. 28 depict a capsule 330 fabricated as an insert into which a sealing plug is molded, as shown in FIG. 29, or alternatively the capsule and plug can be co-molded. Sleeve 332 of capsule 330 is configured with interior threads 334 for engaging a threaded portion of the bottle neck, a preferably tapered base portion T for providing a substantially smooth interface with the bottle. A recess 336 in the interior of the cap portion is preferably configured with protrusions 338 (such as interior ridges) for a molded plug (not shown) to adhere to. Preferably, the sealing plug may be insert molded or co-molded into the capsule using traditional synthetic cork materials as, or similar to, those described by synthetic cork patents by SupremeCorq™, such as U.S. Patent No. 5,480,915, incorporated herein by reference.

[00217] FIG. 29 exemplifies closure capsule 330 shown with a molded plug

sealing the mouth of a bottle. Capsule 330 is shown retained on bottle 340 having exterior threads 342, narrowed neck N, and choke ring R. The tapered T base portion of closure capsule 330 allows the base of the capsule to closely conform to the bottle exterior at the base of the capsule. It should be appreciated that the lower portion of the capsule may be tapered within any of the various closure embodiments described herein. A plug 344 is shown molded within recess 336 over protrusions 338.

[00218] Preferably, the plug is co-molded or insert molded directly into the capsule. It will be appreciated that extruded synthetic corks may be fabricated in a variety of ways and materials, examples of materials and fabrication being described in synthetic cork patents, such as patents by Nomacorc™, including U.S. Patent No. 6,355,320, or patents by Neocork™, including U.S. Patent No. 6,153,275, which are incorporated herein by reference.

[00219] FIG. 30 and FIG. 31 exemplify another embodiment of closure 370 having a two-part top with either a molded plug insert or an extruded and bonded plug insert. The closure 370 is also referred to herein as Design 55, and has a sleeve 372 configured for surrounding bottle neck 374. Sleeve 372 has internal threads 376 for engaging mating threads 378 above choke ring 379 on bottle 374, and an upper surface 380 for engaging a cap 382 with underside recess 384 into which a plug 386 is retained. A shallow top side recess 388 is additionally shown as an optional decorative element to better simulate the top of a foil finished bottle top.

[00220] If the sleeve and cap are not bonded to one another, then it is preferable that an overwrap sleeve be utilized for providing a tamper indicator. It is generally preferred, however, that after fabricating sleeve 372 and cap 382 with plug 386 as separate elements depicted in FIG. 31, they be permanently, or removably, joined to one another, such as by mechanical means, welding, adhesives and/or another convenient form of bonding, as shown inserted in a bottle in FIG. 30. Removable joining allows the cap to be separated from the sleeve to use as a so called "bartop" cap while retaining

the sleeve which can be used to aid removal of the cork whenever necessary. Sleeve 372 is preferably configured with a sharp upper perimeter to facilitate drip-resistant pouring from the bottle. It should also be appreciated that plug 386 may be fabricated from natural or synthetic cork materials as a sealing element which is bonded in place within the capsule, which may then be more properly considered a Type 1 closure.

[00221] FIG. 32 through FIG. 43 describe embodiments of a cork-free closure having a threaded sleeve for opening the closure. These designs can be utilized to implement both Type 3 and Type 4 closures.

[00222] Type 4 closures according to the present invention reduce the risks associated with explosive egress of stoppers, such as can arise when opening sparkling wine or other pressurized fluid containers. A preferred embodiment of this Type 4 closure utilizes a sealing element similar in shape to that of a plastic champagne stopper. Unlike synthetic corks, these forms of plastic stoppers have been used extensively for sparkling wine (i.e. "champagnes") and other pressurized fluids and represent a versatile form of closure that may be utilized with any fluid type, and in particular both still and sparkling beverages. Type 4 designs described by the present invention provide a safety mechanism which retains the stopper during both storage and shipping, while further preventing the stopper from becoming a ballistic projectile as a result of uncontrolled stopper egress as the bottle is opened. One method of readily implementing this safety feature on closure capsules is by increasing thread length of the sleeve portion of the capsule beyond the plug length as described for Type 2 closure designs, while simultaneously restraining the plug from leaving the proximity of the capsule.

[00223] FIG. 32 exemplifies a Type 4 embodiment of a closure 390 which is particularly well suited for use on sparkling wines or similar beverages and which is also referred to herein as Design 44. A sleeve 392 is shown surrounding the neck of bottle 394 having external threading that engages a threaded interior 396 of the sleeve. A plug engagement portion 398 of sleeve 392 preferably extends past the opening of bottle 394 to engage a plug 400.

The circumferential sides of plug 400 are configured to engage and seal with the interior of bottle neck 394, preferably at least one, and more preferably two, ridges protrude from plug 400 to increase seal integrity. The underside of head 404 of plug 400 is configured for receiving an axial force from contact with engagement portion 398 of sleeve 392, which applies extraction force against plug 400 in response to rotation of sleeve 392. Preferably plug 400 and engagement portion 398 are configured to slide by one another and independently rotate, so that the torque supplied on sleeve 392 need not overcome the rotational friction of plug 400 within the bottle.

[00224] Design 44 is shown utilizing similar capsule 392 and cap 406 components as described for previous Type 1 closure capsule enclosures; however, the periphery 408 of cap 406 is preferably permanently bonded to the sleeve (capsule) 392, such as within a recess 410, (or semi-permanently joined, such as an unlockable configuration) to prevent the sealing element (plug) from working loose during shipping or storage, and so that the bonded cap prevents uncontrolled explosive egress of plug 400.

[00225] Preferably head 404 of plug 400 is not attached to the underside of cap 406, wherein plug 400 is trapped under cap 406 while being free to rotate and move slightly to accommodate sealing. The cap and capsule may be manufactured from any convenient and easily workable material, such as those proposed for Type 1 closures, one such preferred material being polycarbonate. The sealing plug 400 is preferably manufactured from a softer material than sleeve 392 or cap 406. By way of example and not of limitation, sealing plug 400 may be manufactured from soft plastics such as low density polyethylene (LDPE), polypropylene, or similar polymeric materials. The thickness of the LDPE or other plastic utilized can be increased in order to limit the extent of gas permeation through the plug.

[00226] FIG. 33 through FIG. 38 depict by way of example and not of limitation, a number of preferred geometries into which plug 400 may be manufactured. FIG. 33 depicts an "open-end" configuration 430 having a hollow open end 432 and protruding ridges 434 about the exterior of plug 430. Variations of

"H" plug configurations 440, 450, are shown in FIG. 34 and FIG. 35, one having a non-planar, preferably curving, seal member 442, and the latter having a straight sealing member 452. The sides of the plugs terminate in open ringed top head 444, 454. Open top configurations 460, 470 are shown in a long and short version respectively in FIG. 36 and FIG. 37. These open-top 462, 472 plugs are preferably formed with sealing ridges 464, 474 about their periphery and a closed bottom 466, 476.

[00227] It should be appreciated that a wide variety of closed plug shapes may be created which seal the opening in the bottle and provide a structure which may be engaged by the closure capsule. Furthermore, the shape and material composition of the interior of the plug can determine the force required to compress the plug when inserted into the bottle. By way of a further example of this variety, a two piece plug 480 is shown in FIG. 38 with a non-sealing head member 482 joined to an open top seal 484 having sides 486, preferably ridged. The head member 482 is shown engaged with a seal 484 at junction 488, such as by joining mechanically, weldment, adhesives or combinations thereof. To prevent leakage, the sealing element should not have material interruptions that disrupt the circumferential seal with the bottle.

[00228] It has been found for conventional still wine bottles that the plug will be retained in the bottle without the need of a retention cap if plugs extend down into the bottle at least one and one half (1.5) inches, which is approximately two bottle-neck inside-diameters. In this case cap and capsule can remain separate as they are in Type 1 closures, because the shape of the inside of the bottle neck holds a plug of sufficient length.

[00229] FIG. 39 exemplifies an embodiment of a one-piece plug capsule 490 which is also referred to herein as Design 40. This readily manufactured closure 490 integrates the plug into the capsule. A bottle 492 is shown sealed with a plug capsule 490 having a sleeve 494 with internal threading 496 for being engaged by exterior threads 498 on bottle 492. A head portion 500 spans the top while a plug 502, preferably with ridges 504 extends down into the interior of bottle 492 whose top is sealed by head portion 500.

[00230] A sufficiently compliant material should be selected for plug capsule 490 to provide sufficient seal integrity; however, sufficient rigidity is also desirable to translate rotational force on sleeve 494 to an axial extraction force on plug 502. It will be appreciated that the rotation of sleeve 494 is not in this case independent of the rotation of plug 502, wherein the depth of plug 502 and use of ringed seal protrusions can be adapted so that undue torque is not necessary for removing the closure from the bottle. By way of example, the one piece closure 490 may be manufactured from a low density polyethylene (LDPE), a polypropylene, or various other similarly soft plastics. The thickness of the soft plastic material may be selected to be a sufficient thickness to adequately limit gas permeation. It should be readily appreciated that Design 40 can be practiced with any convenient plug style, such as those described in FIG. 33 through FIG. 38, those known in the art, combinations thereof, or variations obvious to one skilled in the art.

[00231] Furthermore, it should be appreciated with the one-piece closure and other cork-pulling style closures described previously, that the capsule and bottle are designed to threadably engage one another. The capsule, as well as preferably the bottle neck, are designed to integrate with one another. It should be noted that different capsule styles may be utilized on a single threaded bottle neck design, while many bottle neck styles may conversely be utilized with a single capsule style. It is contemplated that bottle necks will be standardized for use with the cork pulling capsules of the present invention, wherein manufacturers and bottlers can vary the structure, configuration, and ornamental design of the capsules to suit aesthetic, cost, and marketing considerations.

[00232] FIG. 40 through FIG. 43 describe variations of plug to bottle sealing as examples of bottle shapes near the bottle neck opening. The relatively large dimensional tolerances on bottles, resulting from conventional glass manufacturing processes, have led to the predominant use of certain shapes within the top portion of the bottle neck, such as the upper one half (1/2) inch. Typically the interior of bottle necks as represented by FIG. 40 and FIG. 41

have at least two tapers, a top taper and a bottom taper. The bottom taper 510, 512, typically tapers in toward the center of the bottle neck as you move up the neck, while the top tapers may taper inward 514 or outwardly 516. The bottom taper is always tapered in as to retain the cork. It is preferred that the sealing element provide sealing near the top of the bottle. FIG. 42 and FIG. 43 depict a plastic plug 518 with sealing ridges 520 engaged in the neck of the inward 514 and outward 516 tapers described.

[00233] Sealing surfaces of sealing plugs could extend down into the interior of the bottle neck for a distance of up to approximately the length of a traditional cork. Although any of these sealing plugs, or corks may be utilized, it should be appreciated that the critical sealing surface is the one positioned near the top of the bottle. A reverse tapered condition, as shown in FIG. 40 and FIG. 42, can result in unseating of circumferential sealing surfaces further down the bottle neck. If no sealing surface is present proximal the top of the neck opening and a reverse taper condition is present, leaking will occur. The placement of this sealing element proximal the top of the neck is an important consideration for any plug design, in particular the design of short plugs. In the case of a straight neck or tapered out neck, as shown in FIG. 41 and FIG. 43 the design retains many sealing surfaces into contact.

[00234] For a less expensive wine closure solution, and one that eliminates all drawbacks of corks and cork-like stoppers, stoppers can be eliminated altogether and replaced with novel forms of screw-caps. A substantial impediment to wider adoption of screw-type caps by the wine industry is the association of these closures with lower quality wines. The screw-cap appearance, however, can be avoided on the finished wine package by utilizing the closure capsules according to the present invention on bottle designs adapted for receiving them. Non-cork designs utilizing the closure capsules and bottles of the present invention are virtually indistinguishable from a foil-capsule-finished bottle, at least until the bottle has been opened. These screw capsules have a skirt which is molded to mimic the look of the foil wrapping over a traditional bottleneck. The skirt itself may be configured

to separately engage the threads of the bottle to hide them after the cap closure has been removed. Additionally, these closure capsules can be configured for being retained on the bottle, or more preferably rethreaded back onto the bottle, after the sealing element has been removed. Removable caps may be utilized for resealing the bottle and hiding bottle threads, while the sleeve may retained on the bottle neck or configured for being rethreaded onto the bottle neck to increase aesthetics, and optionally provide a drip-resistant pouring spout.

[00235] FIG. 44 through FIG. 47 exemplify an embodiment of a rotatable sleeve closure capsule 530 which seals a bottle without a plug and is referred to herein as Design 21. In this embodiment, the bottle is sealed over its opening (rim of the pouring spout) instead of within the interior of the bottle opening by means of a plug or stopper (i.e. cork). The Design 21 closure is exemplified as a generally two-piece design comprising an elongated sleeve, length exceeding diameter, joined to a cap with integral seal. A bottle 532 is shown in a preferred configuration with a shaped narrowed neck region 534, such as within the corkage area of the bottle, with exterior threads 536 configured to threadably engage the threaded interior of a sleeve 538 and with a choke ring R for grasping the bottle during manufacturing. Closure capsule 530 is configured to slip over bottle 532 and to engage a cap 540 having a seal 542 configured for retention in contact with the opening of bottle 532 when capsule 530 is threaded down on the bottle neck. The combination of sleeve 538 held in a recess of shaped neck 534 provides a smooth transition that appear like a conventional foil-wrapped cork-stopped wine bottle, although other desired aesthetic configurations may be supported. Threading 544 on the interior of cap 540 engages exterior threads 536 of bottle 532.

[00236] Sleeve 538 is shown preferably joined to cap 540 with a mechanical latching mechanism 546, such as a sharp lip on the sleeve engaging a sharp edge on cap 540, which is best seen in the detail view of FIG. 45. Sleeve 538 is shown preferably retained to bottle 532 by fingers 548 which engage the recessed choke ring R in the exterior of bottle 532. In operation, as cap 540

is rotated, fingers 548 engage bottle 532 in choke ring R and deflect causing the area at the base of the fingers to displace outwardly, thereby changing the interface angle of the mechanical attachment which releases cap 540 from its attachment with sleeve 538. The cap 540 may then be removed from bottle 532 while retaining sleeve 538 on the bottle. Cap 540 may also be rethreaded on bottle 532 at any time.

[00237] FIG. 46 depicts a tamper-indication feature for engagement of substantially straight fingers 548 engaging a recess, such as the choke ring R depicted in FIG. 45. This straight-fingered embodiment allows sleeve 538 to rotate on bottle 532 unhindered by the fingers, but it preferably snaps free of the recess when opening is attempted. FIG. 47 by contrast depicts ratcheting fingers 552 engaging ratchet indentations 554 (not shown). The rotation of sleeve 538 with ratchet fingers 552 about bottle 532 with ratchet indentations 554 requires some increased torque in a first direction, but substantially increased torque for movement in a second direction. Both embodiments provide a tamper-indicator and prevent a loss of seal integrity from inadvertent capsule rotation, while providing a means by which cap 540 may be separated from sleeve 538.

[00238] It should be appreciated that the mechanical engagement of sleeve 538 with cap 540 may utilize other forms of both joining and disconnection, for example having the sleeve and cap break away from one another in response to rotational forces, the radial displacement of the cap or sleeve, such as in response to engagement of engagement fingers with the bottle, or ratcheting forces wherein the periphery of the sleeve and cap are separated.

[00239] Cap 540 may be configured to seal down upon bottle 532 with any convenient seal element, such as the flat seal 532 as shown in FIG. 45, or alternatively shaped seals which may be joined to or integrated with cap 540. Also, other forms of stoppers that are not joined to the capsule may be combined with the tamper features describes in FIG. 44 through FIG. 48. It should also be noted that other forms of tamper-indicators may be alternatively, or additionally, implemented using a frangible indicia element

spanning between the capsule and the exterior of the bottle. A torn or broken indicia being indicative of a broken bottle seal. By way of further example, a neckband label may be applied over the boundary between the bottom of the capsule and the glass neck for providing a form of tamper indication. Other forms of tamper labeling that may be provided include, wax-stamp impressions, ribbons, threads, and similar frangible elements.

Furthermore, tamper-indicating mechanisms may be employed which prevent unintentional disengagement of the bottle seal, such as by limiting capsule rotation. By way of example, the direction or extent of capsule travel can be constrained to require high torque forces prior to compromising the bottle seal and while providing a suitable indication when the bottle seal has been compromised.

Other tamper-indication features that may be utilized within the present invention may be implemented by having portions of the capsule separate under the forces involved with breaking the bottle seal. Examples of these tamper-indicating features include, separation of the base of the sleeve in response to rotation of the sleeve, separation of a cap element from a one-piece sleeve, separation of a collar element, and similar forms of material separations and combinations thereof.

It will be appreciated that preventing an inadvertent loss of bottle sealing may be generally improved by increasing the rotational torque threshold above which the bottle seal is broken. Maintaining seal integrity in this manner may be embodied as an aspect of a separable section as described above for providing a tamper indication. Another alternative for preventing inadvertent seal loss is to configure the capsule to partially lock onto a portion of the bottle such as the choke ring, the threads, or other bottle structural features, such as added grooves, or protrusions. For example, this can be achieved by incorporating locking fins inside the capsule, which pass over the bottle threads when initially threading on the capsule, and which then lock into place and engage the choke ring preventing the capsule from being easily removed. Upon attempting to unscrew the capsule, the fins resist the

upward movement of the capsule until the axial force resulting from the applied torque exceeds a threshold at which point the fins either break or are at least sufficiently plastically deformed, thereby signaling that the bottle seal has been broken. Tampering therefore is evident on bottles having a freely rotatable cap.

[00240] Although FIG. 44 is described as a two piece closure, it should also be appreciated, that the sleeve and cap may be permanently joined to produce a one piece closure similar to that shown in FIG. 39, yet providing a seal on the top exterior of the bottle and not the interior of the bottle neck.

[00241] FIG. 48 through FIG. 56 exemplify additional forms of closure capsules according to the present invention. FIG. 48 depicts a closure capsule 570 comprising a sleeve 572 with removable cap 574 engaged within the upper portion 576 of sleeve 572. To provide pleasing aesthetics, the design of this closure capsule can be similar to the closure capsules utilized for extracting a cork, albeit preferably utilizing a screw-on style cap instead of a snap-on cap to ensure the integrity of the primary seal. FIG. 49 depicts closure capsule 570 sealing a bottle 578. A means for sealing the top of bottle 578, depicted as a substantially planar bottle seal 580, is retained in contact with the rim of the pouring spout of bottle 578 as bottle threads 582 engage interior threads 584 of sleeve 572. After removal of closure capsule 570, the bottle may be resealed by removing cap 574 from capsule 570 and threading it onto threads 582 of bottle 578 as shown in FIG. 50. Alternatively, the means for sealing sleeve 572 to bottle 578 may be configured with a removable seal element in place of seal 580, such as a planar snap-in seal, thereby allowing rethreading of sleeve 572 onto bottle 578 which is then resealed by reapplying cap 574.

[00242] FIG. 51 details the upper edge portion 576 of closure capsule 570 which is preferably configured with a sharp edge 586 configured for being drip resistant, and a recess or slot 588 configured for receiving reseal cap 574. A compliant bottle seal, comprising a flexible extending ring 589, is shown for sealing the top surface, rim, of bottle 578 despite any slight irregularities or imperfections that may exist in the bottle surface.

[00243] A reseal cap is shown in many of the embodiments of the present invention, such as in FIG. 49; however, it will be appreciated that a disc, or similar substantially flat seal element, can be utilized in place of the cap without departing from the teachings of the present invention. For example, a disc seal may be formed which snaps in and out of the top of the capsule and which upon resealing of the bottle, is held tightly against the top of the bottle by reapplication of the sleeve. It will be recognized that as an alternative the seal may engage an interior portion of the pouring aperture of the sleeve, such as by integrating a plug.

[00244] FIG. 52 through FIG. 55 exemplify an alternative embodiment of closure capsule 590 on a bottle 592. Closure capsule 590 is configured for separating into two parts, specifically into a screw cap portion 594 and a substantially rigid cylindrical sleeve 596. Screw cap portion 594 is adapted with an integral seal 598, or a separate sealing element sandwiched beneath screw cap 594 and the top rim of bottle 592. The combination bottle 592 with capsule comprising cap 594 joined to sleeve 596 has the appearance of a single-piece foil capsule. To remove screw cap 594, the user can place a first hand surrounding the neck of the bottle and sleeve 596 with the alternate hand twisting off screw cap 594. FIG. 53 depicts bottle 592 after removal of screw cap 594, wherein sleeve 596, being preferably configured with integral threads 600 can be threaded up the neck of the bottle to cover the exterior bottle threads. The edge 602 of sleeve 596 can be adapted to provide drip resistance for the pour spout, such as configuring the top with a sharp edge to eliminate drips. It will be appreciated that wine, or other retained beverages, often "dribble" down the neck of conventional bottles when pouring, wherein the drops may fall on tablecloths, clothing, or the floor requiring inconvenient cleanup and possibly leaving a stain. FIG. 54 depicts the reseal cap 594 that has been separated from sleeve 596, such as when unscrewing cap 594 from bottle 592. It will be appreciated that reseal cap 594 may be replaced on bottle 592 when sleeve 596 is removed from the bottle or the sleeve is otherwise retained below the bottle threads.

[00245] The interface between sleeve 596 and bottle 592 may be additionally configured to resist sleeve rotation. By way of example, ridges, ratcheting protrusions, threading (i.e. additional bottle threading for engaging sleeve, these additional threads having less thread pitch than the pitch of threads used for engaging the cap), and/or other forms of increasing rotational drag may be utilized to aid separation of screw cap 594 from sleeve 596.

[00246] FIG. 55 exemplifies a one-piece closure capsule 610 having a body 612 with interior threading 614 and a bottle rim seal 616, which is shown in detail in FIG. 56 with integral seal 618.

[00247] FIG. 57 and FIG. 58 depict another embodiment of single piece closure 630 in which the neck of bottle 632 is surrounded by a threaded sleeve 634 having internal threads 636 which engage exterior bottle threads to retain a seal 638 on the rim of bottle 632. To prevent the capsule from moving during transit, which could compromise seal integrity, and to provide a tamper indication a plurality of protrusions 640 are shown engaging a recess, such as the choke ring as shown or other bottle recesses, which may be configured as a smooth groove or have protrusions to prevent inadvertent rotation of capsule 634.

[00248] FIG. 59 and FIG. 60 depict an embodiment of a modified single piece closure capsule similar to that of FIG. 57, which is adapted as a two-piece closure capsule 650 utilizing a separate reseal plug. A bottle 652 is shown with a sleeve portion 654 of the closure capsule 650 surrounding the bottle neck. Threads 656 on the interior of sleeve 654 engage threads 658 protruding from bottle 652. A choke ring R shown beneath threads 656 facilitate manufacture. A seal plug 660, is configured to engage the top surface and a portion of the inner surface of bottle 652 (although it may be alternatively configured to engage either surface). A lip 662 is shown extending from the upper surface of sleeve 654 to retain reseal plug 660 against the opening of bottle 652, with the reseal plug being retained in recess 664 at the upper end of sleeve 654. Reseal plug 660 is shown with a seal flange 666 which may be configured with an integral seal (as shown) or with a

separate seal joined to the plug, and a protruding plug member 668 which is preferably integral to reseal plug 660, although it may be joined to reseal plug 660.

[00249] FIG. 61 through FIG. 65 exemplify another embodiment of a bottle 670 for receiving a closure capsule 682 which incorporates a tamper indication feature, illustrated in the form of a break-away skirt. In FIG. 61 a bottle neck 672 with threaded portion 674 is shown with a transition region 676 into which a threaded sleeve of the closure capsule fits to provide the desired aesthetics of the finished bottle, such as the substantially smooth neck transitions characteristic of bottle necks traditionally overwrapped with thin metal or plastic, often referred to as foil-finished. A protruding ring 678 is shown extending just above transition region 676 of bottle neck 672. A recess R, referred to herein as a choke ring, is shown near the top of the bottle neck below threaded portion 674.

[00250] FIG. 62 depicts a partial cutaway of a sleeve 682, which is threaded down upon bottle 670. Sleeve 682 comprises an upper portion 684 and a breakaway skirt 686. Sleeve 682 is shown applied over bottle 672 with break-away skirt 686 engaged past ring 678. FIG. 63 provides a detailed view of break-away skirt 686 attached to upper portion 684 of sleeve 682. The lower portion of break-away skirt 686 preferably has a tapered section T configured to provide a substantially smooth transition from the narrowed portion N of the bottle to the remaining portions of bottle 672 as shown. Breakaway skirt 686 is partially joined at seam 690 to upper portion 684 of sleeve 682 so that skirt 686 will cleanly separate from upper portion 684 when subjected to a sufficient force, such as preferably a similar level of force produced from rotational torque applied to similar sleeves, such as Type 1 closures, when extracting a bottle cork.

[00251] It will be appreciated that sleeve 682 may be manufactured as a single piece (i.e. molded) having perforations, commonly known as slitting, or other separation relief, on a circumference above break-away skirt 686. More preferably, break-away skirt 686 can be sonically welded 690 to upper portion

684 of sleeve 682, such as at select locations about the circumference. It should be appreciated that other means for providing force induced separation of elements may be utilized without departing from the teachings of the present invention.

[00252] A plurality of engagement tabs 692 can be clearly seen in FIG. 64 within the interior of break-away skirt 686. These break-away (or bend-away) tabs 692 preferably provide a compliant inner element, as shown, to allow closure capsule 682 with break-away skirt 686 to be applied in one piece to the neck of bottle 672. FIG. 65 illustrates by way of example a finished bottle neck fitted with the closure capsule of the present invention. It should be recognized that necked bottles having a wide variety of shapes and sizes can be adapted for use with a similar closure capsule adapted to fit the bottle shape according to the present invention.

[00253] FIG. 66 through FIG. 70 depict additional tamper indication mechanisms for bottle closures according to the present invention. It will be appreciated that a tamper indicator can be provided by restraining movement of a first portion of the closure capsule, whereupon in response to movement of a second portion in an effort to open the container, said second portion separates from said first portion. This form of tamper indicator also requires deliberate effort to open the bottle thereby preventing loss of seal in response to moderate (i.e. inadvertent) applications of torque, while it generally leaves indications when the bottle is opened since the separation between portions is visible.

[00254] FIG. 66 and FIG. 67 depict an embodiment of bottles utilizing unidirectional protrusions to facilitate a tamper indicator. FIG. 66 illustrates a bottle 700 having a corkage area 702 with external threaded section 704, and protrusions 706 near the base of corkage area 702. FIG. 67 depicts a closure capsule 708 engaged over the neck of bottle 700, having upper portion 710. It will be appreciated that this embodiment may be practiced with a variety of corked, or corkless closures according to the present invention. Protrusions 706 extend into or through the base of closure capsule 708 which has been

pressed down over protrusions 706 as a result of threading it onto the bottle. Protrusions 706 are preferably formed with a gentle transition in a first rotational direction about the bottle, and a sharp transition in the opposing direction of rotation. These "unidirectional" protrusions allow closure capsule 708 to be rotated over the protrusions in a first direction (i.e. installation), yet lock onto the sharp transitions on the unidirectional protrusions 706 when rotated in the opposing direction (i.e. bottle opening). The base portion of closure capsule 708 is shown in a preferred configuration being segmented, such as with perforations 712, or other means of reducing the force required to separate the upper portion of closure capsule 708 from the lower portion retained by the protrusions.

[00255] It will be appreciated that during the bottling process, closure capsule 708 may be readily engaged over the unidirectional protrusions following a first direction of rotation, preferably clockwise rotation (as seen from the top of the bottle). To open the sealed bottle, the user applies a torque on closure capsule 708 in a second direction, preferably a counter-clockwise direction. As closure capsule 708 is held firmly in that direction over protrusions 706, upon applying a sufficient torque, the base of capsule 708 separates at perforations 712 allowing the upper portion of capsule 708 to be removed along with the associated bottle seal.

[00256] FIG. 68 through FIG. 70 depict another embodiment for retaining the capsule or lower portion of the capsule. FIG. 68 depicts a bottle 720 shown with a corkage area 722, external threading 724 and a ring depression R, such as below the corkage area. A closure capsule 728 is depicted in FIG. 69 engaged over the narrowed portion N of the neck of bottle 720 until a snap ring 730 has engaged depression 726. FIG. 71 depicts in detail the engagement of snap ring 730 with ring depression 726. Preferably the lower portion of closure capsule 728 is segmented to facilitate separation in response to sufficient applied torque for opening the bottle. The snap ring 730 engaging ring depression 726 serves as a latch, that prevents the seal from being broken in response to low levels of applied torque. Additionally,

the separation of the lower portion of the sleeve on capsule closure under sufficient torque to break the seal, provides a visual indication that the bottle has been opened.

[00257] FIG. 71 and 72 exemplify additional embodiments of closure capsules which utilize a two-part synthetic stopper comprising a shank portion formed from a substantially rigid frame over which a layer of compliant material is retained to form the stopper. This structure provides the desired sealing properties and low cost of compliant polymer plugs with the structural rigidity consistent with cork stoppers. In addition, the use of synthetic stopper materials eliminate the risk of TCA (cork taint) problems associated with the use of conventional cork materials.

[00258] FIG. 71 depicts a two-part closure capsule 750 attached to a bottle. A threaded sleeve 752 with interior threads 754 is shown threaded down upon a bottle 756 having exterior threads 758. Bottle 756 is preferably adapted with a taper from the traditional thickness 760 and shape to a narrowed region N, wherein after receiving threaded sleeve 752 the interface 764 between the sleeve and bottle provide a generally smooth transition consistent with traditional foil-wrapped bottles, although other desired shape transitions can also be supported.

[00259] An annular engagement structure 766 is shown proximal to the rim of bottle 756 for engaging the stopper for supplying the necessary extraction force through a head member 768 coupled to a protruding portion of stopper 770. It is preferred that the coupling between stopper 770 and head member 768 (or alternatively directly to annular engagement structure 766 of sleeve 752) be a substantially easily rotatably engagement so that stopper 770 is not required to rotate in response to the rotation of sleeve 752, which would substantially increase the torque required for removing the stopper while subjecting the stopper arrangement to undue torque forces.

[00260] Stopper 770 comprises a two-part synthetic stopper having a length preferably exceeding approximately one inch (1"). An engagement member 772 (latch) on stopper 770 is configured for being engaged by head member

768, preferably extending past the bottle rim (mouth), although alternatively it can be partially, or even fully, recessed within a portion of the neck of the bottle. Engagement member 772 is joined to a stopper frame 774 which comprises a substantially rigid structure capable of withstanding the necessary extraction forces. Stopper frame 774 is preferably configured having a large diameter, such as a diameter that is preferably about one half to three quarters of the inside diameter of the bottle neck. The stopper frame may be implemented with either an open or closed frame construction. An elastic layer 776 is joined to the exterior of frame 774 to provide a seal with the interior of bottle 756. The large frame beneficially reduces the amount of material required in the elastic layer and controls the pressure applied by the elastic layer against the interior of the bottle neck. This can provide a good seal while reducing the radial forces inside the stopper relative to prior art synthetic closures (such as SupremeCorq, Nomacorc, Neocork), thereby substantially reducing the axial pull force required to remove the stopper. This embodiment can be considered a variation of the two-part anchor embodiment depicted in FIG. 1 through FIG. 10, in which the rigid frame is considered the shank of the two-part anchor and the compliant material joined to the rigid frame is considered the stopper. It should be appreciated that stopper 770 may be implemented in various lengths and sealing configurations, such as incorporating a planar seal which provides a seal against the rim of the pouring spout of bottle 756.

[00261] By way of example frame 774 may be implemented as a closed exterior structure, such as a hollow cylinder having a sufficiently irregular surface to promote bond adhesion with elastic layer 776. Alternatively, frame 774 may be configured as an open exterior structure whose exterior is sealed by elastic layer 776 joined over it. Preferably the frame is a major percentage, over 50%, of the inner diameter of the bottle neck into which the combination of frame and compliant layer forming the stopper are to be inserted. More preferably, the frame is adapted to fill at least 66% of the bottle inner diameter. Frame 774 and elastic layer 776 preferably comprise polymer

materials with the material used for the frame having less compliance than the material utilized for the elastic sealing layer. The material of elastic layer 776 is selected to conform to the non-uniform inner diameter of the bottle neck and to the very small changes in texture that are encountered in glass bottles in order to provide a superior seal. Furthermore, elastic layer 776 should be capable of being easily deformed to simplify extraction, such as in response to minimum axial stopper extraction forces of about twenty five pounds. Elastic layer 776 provides improved sealing capability against the glass surface at lower radial forces than are required with current synthetic stoppers. A small amount of food grade lubricant may be optionally utilized over elastic layer 776 during bottling to reduce friction during insertion. By way of example, stopper 770 may be manufactured in an insert-molding or co-molding process.

[00262] Engagement member 772 on the upper portion of stopper 770 provides a means for coupling extraction forces from sleeve 752 to stopper 770. Preferably, the diameter of engagement member 772 is configured as a substantial percentage (i.e. over 50%) of the diameter of the stopper, wherein cork extraction forces are spread over a larger coupled surface area to more easily withstand the cork extraction force. By way of example the means for coupling is depicted as at least one protrusion engaging at least one mating recess, although other forms of engagement may be utilized. Preferably the means for coupling can be engaged by the application of forces which are substantially less than required for disengagement. For example once stopper 770 is engaged with head 768 it will not become disengaged in response to the application of necessary stopper extraction forces, and preferably could not be readily disengaged at all.

[00263] Unidirectional compliant fingers 778 with engagement ribs 780 are shown for engaging the ribbed exterior of engagement member 772. It will be appreciated that in the embodiment depicted, head 768 may be joined over stopper 770, after stopper 770 and sleeve 752 have been installed on the bottle. A recess 782 is shown in the center of engagement member 772

which can both reduce the material requirements and be formed in a tooling-compatible shape for being engaged by automated equipment for installing stopper 770.

[00264] An annular recess 784 is shown disposed on an upper portion of sleeve 752 for retaining a cap member 786, with optional recess 788. It should be appreciated that cap 786 is preferably implemented on non-pressurized bottles as a reseal cap that may be snapped onto the bottle rim (such as over a small lip), or threaded over the bottle threads to seal the bottle. Cap 786 may be retained on sleeve 752 according to any convenient form of attachment, such as friction fit or threaded within recess 784, attached by a breakable bond, and so forth. The exterior of cap 786 is shown with a small top recess 788 which can mimic the appearance of a foil-wrapped bottle top and may include a logo, indicia, or other forms of trade dress. It should be appreciated that these aspects of the design of cap 786 may be implemented on any of the bottle closure embodiments described herein.

[00265] FIG. 72 depicts another two-part closure capsule 790 having an integral bottle rim sealing means, such as an annular lip, shown in the figure sealing a bottle. A threaded sleeve 792 is depicted with interior threads 794 shown threaded down upon a bottle 796 having exterior threads 798. Bottle 796 is again shown adapted from a traditional thickness 800 to narrowed region 802 with a substantially smooth interface 804 between the sleeve and bottle. Annular engagement structure 806 (annular lip) is configured for engaging the stopper through a head member 808 coupled to a stopper 810.

[00266] The stopper 810 is shown following two-part synthetic construction similar to that shown for the stopper in FIG. 71. An engagement member 812 (latch) is configured for engaging head member 808 and joined to a substantially rigid stopper frame 814 covered by an elastic layer 816, including a flaired-out portion at the top embodied as a planar seal portion 818 configured as a compression gasket for being compressed between annular engagement structure 806 and the bottle rim. It will be noted that use of the planar seal increases overall seal integrity for a given length of stopper 810.

The plug portion of stopper 810 within this embodiment is preferably configured to extend into the neck of the bottle to a depth of approximately five eighths of an inch (5/8"). On the embodiment shown, threading sleeve 792 onto the bottle neck at twenty pound-inches (20 lb-inches) of torque produces a compressive axial force on planar seal 818 of eighty or more pounds ($\geq$ 80 lbs.) of axial force upon the gasket at the rim of the pouring spout. As a consequence of this added seal, closure embodiment 790 is shown implemented with a shorter stopper than illustrated in FIG. 71.

[00267] Unidirectional compliant fingers 820 with engagement ribs 822 are again shown for engaging the periphery of engagement member 812. A recess 824 within engagement member 812 can be configured for engagement by automated equipment. A cap 826, such as for resealing, having an optional recessed (or alternatively raised) center portion 828 is shown for retention within annular recess 830.

[00268] FIG. 73 depicts the upper portion of a wine bottle 850 configured for receipt of a closure capsule in accord with the present invention. A number of design aspects should be considered in creating a wine bottle that is compatible with closure capsules described herein utilizing rotational sleeves for breaking the bottle seal and opening the bottle. The bottle 850 tapers from a base 852 to the bottle neck 854, which traditionally extends smoothly to the rim of bottle 850.

[00269] Aspects of the present invention recognize the importance of appearance, specifically external shape, and more specifically the maintenance of a traditional appearance, such as that of a foil wrapped finish which is a configuration known in the wine industry. Closure capsules according to the invention provide an easy-open bottle closure that can exhibit a traditional appearance when received upon bottles adapted for them. A closure capsule is retained, such as on bottle 850, on an external threaded portion of the bottle. One embodiment of this threading is shown in FIG. 73 with threading 858 on a portion of bottle 850 near bottle rim 856. It should be appreciated that exterior bottle threading may be disposed along any

portion(s) of the bottle over which the threaded closure capsule is to be retained, but the shortest capsule lengths (that is, lengths comparable to the stopper length) will be possible only if the threads extend nearly to the top of the bottle. Also, threading the bottle exterior near its top allows employing the shortest reseal caps which thread onto the bottle top.

[00270] To maintain traditional wine bottle aesthetics when utilizing the closures capsules of the invention, it will be appreciated that the diameter of the neck of the bottle must be smaller in the region covered by the sleeve portion of the closure capsule so that the outside diameter of the closure capsule matches that of the bottle neck just below the capsule. The neck 854 of bottle 850 is shown transitioning near the bottom of the corkage area of the bottle to this smaller, narrowed, diameter 860 through a closure interface region 862 configured with a contour that mates with the interior of the base of the closure capsule so that a smooth transition can be provided on the bottle exterior, regardless of typical tolerances on glass dimensions. This neck region covered by the closure capsule is referred to as the corkage area since it corresponds to the axial segment of the neck in which the cork, or a cork-like stopper, resides in bottles containing them. The smaller external neck diameter in the corkage area of the bottle extends up from interface 862 to the top of the bottle proximal rim 856, with generally only the threads 858 protruding beyond the capsule neck diameter to engage the interior of the capsule when threaded over the bottle neck.

[00271] The importance of bottle shape in providing pleasing package aesthetics has been described. Manufacturing considerations should likewise be considered, such as considering how manufacturers are to produce bottles compatible with the closure capsules taught herein. According to conventional bottle manufacturing practice, the upper portion of the bottleneck preferably includes a protruding ring by which tooling (i.e. bottle tongs) are able to grasp the bottle during the glass forming (i.e. blowing) production process. In order to remove the bottle from the mold following the industry standard bottle manufacturing process, tongs grasp the bottle under or upon

the protruding ring positioned near the top of the bottle neck. Bottle grasping is traditionally facilitated by providing a protruding ring of glass near the top of the bottle neck, typically located approximately ¼" to ½" below the top of the bottle and which protrudes about forty thousandths of an inch (0.040 inches) to prevent the bottle from slipping out of the grasp of the tongs.

[00272] It should be appreciated, however, that the presence of this protruding ring can complicate the threadable engagement of a closure capsule as described, since the protruding ring generally constitutes an obstacle to closure installation. In order to thread a generally cylindrical closure capsule over the bottle neck, the interior diameter of the closure capsule must exceed the external diameter of the protruding ring. This is generally true unless of course the closure capsule is designed with a compliant base portion, or a flared base portion that can be easily slid over the protruding ring. Although closure capsule may be practiced with bottles having a protruding ring, it is generally preferable according to the present invention to utilize a recessed means by which the bottles may be grasped.

[00273] The recessed bottle grasping means of the present invention comprises one or more recesses about the exterior of the bottle neck configured for being engaged by tooling for holding the bottle. Preferably, the recess is implemented as at least one ringed depression 864, referred to herein as a "choke ring" 864, about the periphery of the bottle neck. Preferably, the choke ring is disposed beneath the exterior bottle neck threads 858 for engaging the closure capsule. This choke ring depression should be at least approximately ten thousandths of an inch deep (0.010 inch), and preferably approximately forty thousandths of an inch in depth (0.040 inch).

[00274] To achieve a desired breaking strength for the resultant bottle, it is preferred that the minimum thickness of the bottleneck be considered and possibly increased to accommodate the narrowing for receiving the closure capsule. Furthermore, on bottles designed for retaining forms of sparkling wines, beers, or other pressurized fluids, the material thickness of the bottle must be sufficient to withstand the pressure exerted by the contents of the

bottle and handling. Although not necessary from a utilitarian standpoint, the region below the choke ring may contain additional threading. The narrowed portion 860 in the corkage area within the present invention can also support the display of, logos, design elements, package labeling, and so forth. By way of example, this circumferential space about the corkage area can be utilized for retaining and displaying information such as contest information, rebates, bottling and lot information, warnings, and so forth in support of business methods. For instance this area may be directly printed upon, or a paper or plastic band containing text or graphics may be installed in the corkage area prior to installation of the closure sleeve.

[00275] It is important that the dimensions of the elements forming the bottle neck be properly considered so as to facilitate use and manufacture of the present bottle with threadable closure apparatus.

[00276] FIG. 73 depict stations A through D along the neck of a bottle for retaining still wines, preferred dimensions and tolerances for each of these stations along the bottle neck are listed in Table 3. The present embodiment of the bottle is configured with a neck in the corkage area that has a smaller diameter than the lower part of the neck just above the shoulder of the bottle, preferably by about one tenth of an inch, to allow for the material thickness of the sleeve on the closure capsule. More preferably, the neck in the corkage area has a diameter about 0.14 inches less than the lower portion of the neck into which it transitions. It will be appreciated that the described closure capsules constitute a structural element for converting a torque force to an axial force for extracting a cork or otherwise removing a bottle seal during opening a bottle. As would be expected an element performing a structural function generally requires a thicker material cross-section than a purely decorative overwrap, such as found in the traditional metal foil overwrappings.

[00277] It is also preferable that the major diameter of the threads in the corkage area of the bottle neck, or any portion along the corkage area to be covered by the closure capsule, does not exceed the minor diameter of the threads inside the closure capsule, as this simplifies fitting the capsule down

onto the bottleneck. Neck flares in some traditional bottle styles, such as associated with Burgundy and Rhone style bottles, are preferably simulated by flaring the outside, but not the inside, of the closure capsule.

[00278] It will be appreciated that other bottle patterns for still wines and forms of sparkling wine or beer and which have different dimensions can be implemented based on teachings herein without departing from the present invention.

[00279] FIG. 74, 75 and 76 depict typical designs for Bordeaux, Rubato, and Burgundy style bottles, respectively, by way of example and not of limitation which are shown configured for receipt of a closure capsule according to the present invention. It will be appreciated that the aspects of the present invention as described herein may be applied to various bottle shapes including those described above as well as Rhone, champagne, and other traditional bottle shapes, the neck portions of which are adapted to receive the threaded closure capsule. The traditional appearance is achieved with these modified bottles after receiving the closure capsule which is threaded down on the bottle neck. In order to minimize departure from the traditional look of these wine bottle patterns the upper portion of the neck covered by the closure capsule is preferably cylindrical with a closure capsule being cylindrical on its interior and exterior which results in a minimal change in bottleneck outside diameter at the point where the bottom of the sleeve of the closure capsule is retained. Moreover, to further minimize the visibility of this change in neck diameter, the transition from smaller to larger diameter can be made smoothly, producing cleaner lines than associated with a sharp transition. The transition region is preferably approximately three-eighths (3/8) inch with rounding at both upper and lower slope changes.

[00280] The present invention is compatible with the utilization and presentation of sparkling and still wines, and other beverages. For example, the present invention is compatible with typical devices that retard the oxidation process after the bottle has been initially opened by drawing a vacuum or filling the air-space in the bottle with an inert gas. The evacuation

method can replace the reseal cap with its own rubber stopper, while the oxygen displacement methods can utilize the reseal cap in the normal way. Both of these methods also can be integrated with the base solutions.

[00281] Accordingly, it will be seen that this invention provides various embodiments of bottle closures which are particularly well suited to sealing still and sparkling beverages, such as wines, within their containers. The described closures may be readily opened in response to user rotation of a sleeve which is threadably engaged with the neck of a bottle, or threading joined to the neck of a bottle. The sleeve engages natural or synthetic corks or plugs directly or by way of anchors engaged within the plug or cork. Various closure embodiments are described which provide for sealing still beverages, while features are described for use on fluids whose contents are under pressure (i.e. sparkling wines, champagnes, beers, and so forth), such as to prevent uncontrolled explosive egress of the plug or cork. Furthermore, those skilled in the art will appreciate that the structural and functional features described for the various reseal caps, anchors, and closure capsules can be substituted among the various embodiments of the invention described, while elements of prior art cork pulling sleeve may also be incorporated to create additional embodiments without departing from the present invention. It should also be appreciated that logos, artistic designs, labeling information and the like, may be incorporated on aspects of the present invention, such as the sleeve, cap, capsule, bottle threads, anchor, and so forth.

[00282] Although the description above contains many details, these should not be construed as limiting the scope of the invention but as merely providing illustrations of some of the presently preferred embodiments of this invention. Therefore, it will be appreciated that the scope of the present invention fully encompasses other embodiments which may become obvious to those skilled in the art, and that the scope of the present invention is accordingly to be limited by nothing other than the appended claims, in which reference to an element in the singular is not intended to mean "one and only one" unless

explicitly so stated, but rather "one or more." All structural, chemical, and functional equivalents to the elements of the above-described preferred embodiment that are known to those of ordinary skill in the art are expressly incorporated herein by reference and are intended to be encompassed by the present claims. Moreover, it is not necessary for a device or method to address each and every problem sought to be solved by the present invention, for it to be encompassed by the present claims. Furthermore, no element, component, or method step in the present disclosure is intended to be dedicated to the public regardless of whether the element, component, or method step is explicitly recited in the claims. No claim element herein is to be construed under the provisions of 35 U.S.C. 112, sixth paragraph, unless the element is expressly recited using the phrase "means for."

TABLE 1

Closure Types

Closure Type	**Fluid pressure**	**Sealing element**
Type 1	atmospheric	Cork
Type 2	up to 6 atmospheres	Cork
Type 3	atmospheric	Synthetic*
Type 4	up to 6 atmospheres	Synthetic*

* Plastic, usually a Low Density Polyethylene (LDPE) or a urethane.

TABLE 2

Closure Designs and Uses

Design	FIG	Type	Uses a traditional cork	Pulls cork with anchor
51	1	1	yes	yes
46	4	1	yes	yes
52	9	1	yes	yes
20	11	2	yes	yes
28	15	2	yes	no
54	16	2	yes	no
45	27	3	no	no
55	30	3	no	no
21	44	3	no	no
40	39	3	no	no
44	32	4	no	no

TABLE 3

Example Bottle Neck Dimensions and Tolerances for use with Closure Capsules

Station	Nominal Diameter	Tolerance
A	1.294* inches	+/- 0.031 inches
B	D - 0.088 inches	+/- 0.020 inches
C	D - 0.160 inches	+/- 0.020 inches
D	A - 0.120 inches	+0.013/ -0.012 inches

*OR any desirable bottleneck diameter.